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A PSYCHIATRIC SURVEY OF FIFTY CASES OF BRONCHIAL ASTHMA*

NEIL T. McDERMOTT, M.D., AND STANLEY COBB, M.D.

INTRODUCTION

A MIDDLE-AGED MAN with long-standing severe asthma had obtained such poor results from several different types of medical treatment that he finally entered McLean Hospital in order that he might be studied from a psychiatric viewpoint. He arrived with a small bag full of medicines which had to be taken at certain times with ritualistic exactness. His physician ordered the nurses to discontinue all medication. The patient was annoyed and soon developed a moderately severe asthmatic attack. The nurses refused to give him the drugs he wanted, so he insisted on seeing his physician. When the doctor arrived the patient was in respiratory distress, the wheezing was audible throughout the room. He asked for his usual medication, but when the physician told him quite firmly that he could not have it he flew into a rage, cursing the doctor, and a moment later the wheezing stopped.

A teacher from the West was seen in the wards of the Massachusetts General Hospital. He was on the "danger list" and during certain nights recently the doctors had fears for his life because of terrifying asthmatic attacks in which he seemed to be exhausting himself. A couple of quiet interviews, between attacks, brought out the fact that ten years before his asthma had started after an attack of "flu." It was mild and merely a slight inconvenience until two years later when he first went to

the hospital. At this time he was embroiled in a faculty fight which ended with the resignation of his chief whom the patient had strongly supported. During the next years the new chief did not advance the patient and he feared he might be dropped. Each winter he spent several weeks in the hospital. Then he had a sabbatical year studying near Philadelphia and went through the winter without asthma. Coming to New England to see his parents two years later, he was free from asthma until his father became seriously ill and died. The patient shortly entered the private ward in the serious condition described above. He improved in a month and was ready to go back to his school. The tickets were bought and reservations made for the next morning. That night he had a severe attack and could not leave the hospital at train time. Two weeks' careful nursing improved him greatly and a week later reservations on the western train again were made. The night before departure the same thing occurred. After a similar experience some weeks later, he was sent home to stay with his widowed mother and told he could not work at all that winter. The last report is that he "got by the winter very well".

Experiences like this occur in the practice of every internist who treats a large number of asthmatic patients. It is common knowledge that asthmatic patients are "nervous", and the older writers accepted the fact as self-evident. Because of such evidence Dr. Francis M. Rackemann, Chief of the

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Anaphylactic Clinic in the Out-Patient Department of the Massachusetts General Hospital, asked the aid of the Psychiatric Department to see, in the first place how often emotions seemed to play a role in asthma, and then to advise as to what could be done about it. The first part of this work—a preliminary survey of fifty cases of asthma taken as they came to the Anaphylactic Clinic—is reported in this contribution. The interviews were carried out by one of us (McDermott) in the Out-Patient Department or on the wards of the General Hospital. Treatment of a few selected cases was undertaken by Dr. Felix Deutsch (3), the results to be reported later.

REVIEW OF THE LITERATURE

Since about 1915, when the facts of anaphylaxis were first applied to human disease, asthma has been considered almost entirely from the allergic viewpoint. Today most textbooks and papers fail even to mention the presence of psychic factors in this disease. The importance of such factors, however, was known in antiquity; Wittkower and Petow (21) quote Hippocrates as saying that the asthmatic person must guard against anger; in 1682 Thomas Willisius noted the presence of emotional factors in asthma and the authors are able to mention several other writers in the older literature who had made similar observations. In 1935 Dunbar's book (4), "Emotions and Bodily Changes", was published. It is a review of the literature on psychosomatic inter-relationships from 1910 to 1933. In the section on bronchial asthma most of the references are German; American workers seem to have been scarcely aware of the problem. Dunbar points out that as early as 1910 Saenger and Brügemann had made extensive observations concern-

ing the psychological factors. Moos (4) writes that the psychopathology is usually the primary and most important factor in asthma. He cites seven cases which had failed to benefit from various medical measures but which were greatly improved by psychotherapy. He believes this is deductive proof that the psyche is the decisive factor and that psychotherapy deserves first place in the treatment of asthma. Later he treated sixteen severe asthmatics with good results. At the end of the treatment he exposed his patients to the allergens thought to be involved and none reacted with an attack. He came to the conclusion that "although allergic substances may represent an increased stimulus for an attack the psychic attitude can prevent, inhibit or favor an attack". He adds that no attack will occur in the presence of the allergen if the psychic component be removed. He says that American writers in particular seem to go to extremes in searching for allergens in asthma to the exclusion of all other factors.

Hansen (9) believes that the majority, if not all, of the cases of bronchial asthma have an allergic diathesis. He thinks that the application of psychotherapy to asthmatics is limited because "it does not seem possible to change the allergic constitution of the patient by psychotherapy. In all my relevant cases the cutaneous reactions remained positive even after the elimination of the asthmatic attacks, *i.e.*, the allergic and specific constitution remained". He goes on to say, however, that the allergic factors should not be over-estimated, adding that in many cases an attack will not occur when the patient is invaded by the allergens unless the organism is already prepared by certain psychic experiences. In 1929, while speaking of disease in general and of asthma in particular, Hansen (9) said, "The aim of this paper is to show

that such diseases, the incitement of which is manifestly subject to pathogenic physical components, are also absolutely dependent in their course, even in their origin, on special psychical influences acting on the patient". Naber (4) concedes greater or lesser roles to allergens, endocrines and other agents in asthma, but he thinks that the precipitating factor in every attack is psychic. In all his cases he was able to discover a psychological factor and by psychotherapy all his patients were cured with one exception. Loewenstein (4), as well as Römer and Kellman (4), also report good results from psychotherapy. Wittkower and Petow (21) believe that, since psychic factors are often important in determining the onset and persistence of asthma, these factors must not be overlooked in the treatment. They conclude that: 1) there may be allergic asthma without a neurotic component; 2) there may be psychic asthma without a somatic component—though rare and not proven, but 3) most cases are doubly determined, *i.e.*, in a person with an allergic predisposition, psychic factors mobilize the latent factors of the disease and make it apparent. In 1926 Ziegler and Elliott (22) studied a few cases of "emotional asthma" by means of spirometers and found that during emotional stress the amplitude and regularity of the respiratory curves were altered, the expiratory phase being particularly prolonged. The control group, consisting of asthmatics with protein sensitization, but no emotional factors, showed no such alteration. Consequently they believe that in the absence of protein sensitization emotional factors may help to explain the disease in a limited number of cases. Hanse (8) and Strauss (20) both consider it a mistake to make a clinical differentiation between "true asthma" and "psychic asthma". Hanse (8) goes on to say

that there is no doubt that "real asthma" must have at its basis an allergic diathesis, but he admits the importance of emotional factors in the disease. He has considered the relationship between asthma and certain body types; he believes that asthmatics usually have the asthenic type of physique. Also, he points out that in those patients who show "vagotonic signs" the asthma seems to be entirely allergic and in those showing "sympathicotonic features" psychic factors often play a large rôle. He concludes that with a constitutional tendency to asthma and an asthenic type of physique a person is likely to develop asthma if there has been some preceding lung damage. Ingvar (11) considers asthma a general biological reaction to allergens localized in the respiratory system. He believes that psychic factors are important and that psychotherapy deserves a place in the handling of this disease, saying that, once the disease is established, attacks may be precipitated by emotions even in the absence of the allergens. Without citing the evidence, he makes the following statement: "Many facts indicate that nervous people, with their generally increased reflex irritability to the influence of their surroundings, also have a lower threshold for the evolution of allergic reactions".

The neurotic mechanisms in asthma have been studied by several writers of the psychoanalytic school of psychiatry. Dunbar mentions that Freud made references to asthma in his earliest papers. Fenichel (5) states that the behavior of the asthmatic is that of a compulsion neurotic with marked narcissism. Oberndorf (14) was able to obtain considerable improvement in a patient with severe asthma by use of psychoanalysis. The Individual Psychologists have also considered this problem and Holub (10) speaks of

"psychogenic asthma" but adds that, "In these cases the allergic predisposition or a constitutional weakness of the respiratory system which is present has been utilized psychically by the patient". He points out that the asthmatic attack serves a useful purpose for the patient by bringing him care and attention.

In his report on one hundred and fifty cases of asthma, Maxwell (13) divided the stimuli which cause the disease into six groups, namely: allergic, nasal, lower respiratory tract, alimentary, endocrine and psychological. The greatest number of the cases showed more than one factor; there were three patients in whom only psychological factors were discovered. He believes that the allergic factor is unduly stressed and that the psychological factor plays the most important single rôle. Seventy-four of his one hundred and fifty cases showed psychological factors and seventy-three showed allergic ones. Gillespie (6) stresses the importance of heredity and neurosis but he does not want to go so far as to say that psychological factors are sufficient in themselves to cause asthma. He writes that asthma seems to be, in part, a disturbance of the vagosympathetic "balance" which is much influenced by emotional states. He believes that the asthmatic attack may be the expression of a state of uneasiness or mental conflict, a means of escape or desire for sympathy. The most recent contribution to the subject is a paper by Strauss (19) on the Psychogenic Factor in Asthma. In this study he asked ten questions to each of thirty unselected asthmatic patients, and in the light of the information obtained decided whether or not the patient was nervous. In sixteen there was a "strong" nervous element; in nine it was "well represented", in the remaining five, weak or absent. There

was, however, no attempt to find out whether this general nervousness was related to the actual attacks.

Most of the work relative to the psychic factors in asthma has been done on adults, but Rogerson (16) and Rogerson and Hardcastle (17) have studied the asthma-eczema-prurigo syndrome in children and its relationship to emotions. The symptoms are seasonal, apparently allergic and the itching and eczema may alternate with asthma, hay fever or gastrointestinal disturbances. The syndrome often starts with infantile eczema, the symptoms often disappear at puberty and heredity seems to play an important part. Rogerson (16) observed that these children usually improved or became free from symptoms while in a convalescent home, but very often relapsed shortly after returning home. No allergic cause for this could be discovered and psychological factors were suspected. It was found that the children were usually quite nervous and showed marked anxiety and insecurity with latent aggressiveness. Also, the parents were often quite over-anxious and over-protective. By means of psychotherapy, directed chiefly towards the parents, good results were obtained. In a series of twenty-five cases, ten were cured and eight were improved. Psychotherapy was beneficial not only for the asthma, but also for the eczema. This last statement is interesting for in Dekker's (2) long list of reasons why he believes asthma is not a neurosis there is a statement that eczema often precedes or follows asthma, but "no one would admit psychic factors in eczema!" Apparently he was ignorant of the considerable mass of evidence which indicates that there may be an important psychic factor in eczema (4).

In the foregoing review of the literature asthma has been considered chiefly

in its relationships to psychological factors of a neurotic nature. There is also evidence indicating a connection between asthma and the major psychoses, particularly manic-depressive psychosis. Reichmann (4) believes that manic-depressive swings are of special frequency in asthmatics. It seems to Hansen (4) that asthmatic individuals not infrequently show some symptoms of manic-depressive psychosis and that the asthmatic attacks are more frequent during the depressive phase. According to Dunbar, Fenichel (4) in his psychoanalytic work has discovered a definite relationship between manic-depressive psychosis and asthma. St. Saxl (4) wrote of a patient who suffered from both asthma and manic-depressive disease and during the acute psychotic attacks the asthma disappeared only to return as soon as the mental state improved. Oberndorf (14) writes of a patient in whom attacks of manic excitement seemed to take the place of the asthmatic attacks. Among seven thousand psychotic patients MacInnis (12) found only five cases to be allergic, a figure much smaller than one would expect in the general population. Three of these cases showed no symptoms of allergy while mentally ill, but in all of them the allergic symptoms returned when they regained their mental health.

OBSERVATIONS

We have studied fifty cases of asthma with particular reference to the presence of emotional factors. The cases were obtained from the Allergy Clinic and Medical Wards of the Massachusetts General Hospital.¹ Since no special selection of patients was made (only young children were excluded),

we believe our cases represent a fairly typical cross-section of the asthma cases treated at this hospital. In the beginning it may be said that we realize caution must be exercised in drawing conclusions from such a small series of cases, but we think that it will be possible to show general trends. The medical records were examined. About two hours were spent with each patient; a careful history of the patient's asthma was taken with particular inquiry concerning any possible psychological factors; in addition, some facts were learned concerning the patient's life story, his heredity and his personality. We were particularly interested to learn whether the first attack, or subsequent attacks of asthma were emotionally precipitated; whether an attack once started from whatever cause was aggravated by emotion and finally whether strong emotion ever alleviated an attack.

EMOTIONAL FACTORS

For the sake of convenience we shall refer to that group of cases showing emotional factors in their asthma as the "emotional group" and we shall call the group in which no emotional factors were discovered the "non-emotional group". A study of the reports (see Appendix) shows that the word "emotion" usually connotes unpleasant emotion. Excitement whether pleasurable or the opposite sometimes caused attacks. Laughing was a common cause but may perhaps be considered more mechanical than psychological. Our series consists of twenty-two males and twenty-eight females. Rackemann (15) states that asthma occurs about equally in the two sexes. In Maxwell's (13) series, females predominated but in Hanse's (8) and Rogerson's (16) series, males predominated.

Thirty patients out of the total of

¹ Dr. Francis Rackemann, chief of the clinic, was most generous and helpful both in allowing us to study his patients and in his interest in our problem.

fifty gave a convincing history of emotional factors in their asthma, seven told stories that were less convincing put pointed to probable emotional factors and in thirteen cases no facts indicating emotional relationships were discovered (*see Chart I*). It is probable that more cases would have been found

tional group" consists predominately of young males and we believe that this class is most likely to deny the presence of psychic factors because of the shame and stigma attached to being considered hysterical.

PRECIPITATION OF ATTACKS

Briefly summarizing the data, we found that in the fifty cases twenty patients thought that the first attack had been precipitated by emotional stimuli; in ten of these the evidence was quite clear. In thirty-one cases later attacks seemed to have been precipitated by psychic disturbance, but in only twenty-one of these was the story entirely convincing. Thirteen patients stated that attacks once started by cold, exertion or any cause, were often aggravated and prolonged by emotion. We believe that this last group is in reality somewhat larger because patients often remarked that their asthma was worse during or immediately after some psychic disturbance, but in tabulation we have included only those patients who remembered clearly certain attacks that were made worse by a definite emotional upset and not by some longstanding state of uneasiness.

In order to illustrate the rôle of emotions in the initiation of the first attack and in the precipitation of subsequent attacks the following is abstracted from a case:

This thirty-seven year old, unemployed salesman was married at twenty-seven years of age. Because of her poor health his wife was advised against having children and, in addition, she had a good job which neither of them wanted her to give up. Shortly after the marriage she became pregnant. The patient was quite worried and emotionally upset and at this time had his first asthmatic attack. During his wife's pregnancy he was often nauseated

SUMMARY OF 50 CASES OF ASTHMA

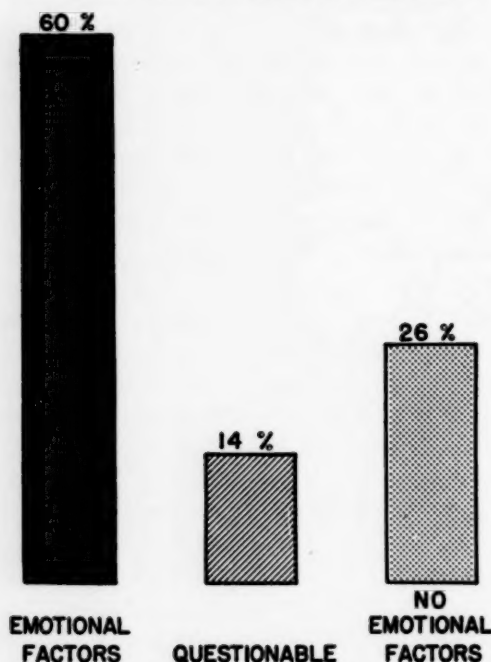


CHART I. Of the 50 patients, 30 gave stories of clear psychological precipitation or aggravation of their attacks (60 per cent); 7 gave stories which strongly suggested such a relationship (14 per cent); and 13 gave no such stories (26 per cent).

to have psychological factors in their asthma had more time been spent with each patient.

In the "emotional group" females predominate in a ratio of about two to one, and in the "non-emotional group" males predominate in the same ratio. The average age of all the patients was thirty-seven years, but the males in the "non-emotional group" average only thirty-one years as against forty years for males in the "emotional group". Hence, the "non-emo-

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and vomited frequently. Recently attacks occur at any time of the year but are worse during the winter. Adrenalin helps the attacks but, since he is frightened by palpitation, he does not like to use it. About five years ago he was given morphine for his asthma and he has gradually become addicted. About a year ago he was taking at least four grains a day regardless of asthma. A few months ago he had himself committed to a mental hospital for treatment of the addiction and since then has been taking smaller doses. During the past seven years he has had approximately forty hospital admissions because of his severe attacks. He believes that his chief benefit from being hospitalized derives from the quiet and rest he receives away from the many irritating factors of home. He will have an attack if he becomes nervous or excited about anything such as paying his rent, fear of some injury to his child and excitement during a card game. He remembers that his asthma was definitely worse when his economic situation became so bad that he had to receive charity.

EFFECT OF PASSION

Dekker points out that anything which increases the "vagal tone" may precipitate an asthmatic attack and he believes that the frequency of attacks at night can be understood on this basis. Also, he states that anything which increases the "sympathetic tone" will inhibit or benefit attacks, remarking that heightened emotions and good spirits elevate this "sympathetic tone". He writes of a man who was in an asthmatic attack at night and was frightened by a zeppelin passing over the house; he jumped up and his attack disappeared. A woman's attack could always be greatly improved by the visit of a dear friend and the effect was so marked that her husband became angry with her since it proved to him that her asthma was "just a caprice". Reasoning from the known

beneficial effects of adrenalin on asthmatic attacks and from Cannon's (1) work on adrenalin and emotions, it seems reasonable to consider the possibility of asthmatic attack being alleviated by strong emotion. The two following cases in our series illustrate this point:

CASE NO. 36, M.G.H. #20074.

A forty-eight year old Finnish-born housewife has had asthma for the past twenty years. When she was twenty-eight years old she was recovering from typhoid fever and her two-year old daughter became quite ill with mastoiditis. She had her first asthmatic attack at this time. The attacks occur at any time of the year, but are somewhat worse in the winter. If she becomes annoyed at her husband or is upset or nervous for any reason an attack will be precipitated. During mild attacks she keeps telling herself to be "calm and happy" because she knows from past experience that if she becomes nervous or excited the attack may become severe enough to make her bedridden. In November 1935 skin tests were positive and she was put on a diet; for fourteen months she had no attacks. Then her husband, who drinks to excess and spends more money than he ought, left home in his car and his whereabouts were unknown for three days. She became quite upset about this, did not know what had happened to him, wondered if he were in jail or if he had possibly been killed. It was during these days of mental unrest that her asthma returned and persisted to such a severe degree that hospitalization was necessary. The patient volunteered the following interesting information: if, during an asthmatic attack, she becomes annoyed at her husband the attack will become worse; however, if she becomes very angry at him and gets into a rage the attack will disappear entirely at once.

CASE NO. 27, M.G.H. #12428.

A thirty-one year old single, unemployed gardener, had whooping-cough at three years of age and each fall after this he had

tients showed a much larger number who were troubled by exaggerated orderliness (68 per cent) and cleanliness (62 per cent) than did the control group (24 per cent and 14 per cent, respectively), but the difference concerning punctuality was not very striking (see *Chart III*).

FAMILY CONSTELLATION

According to Adler's school of Individual Psychology the position a child holds in the family in relation to his siblings is important from the standpoint of psychological reaction. The vulnerable positions in the family constellation are said to be: oldest, the second born, the youngest, the only child and the only boy with several sisters or the only girl with several brothers. With this in mind Haag (7) set out to prove that asthma is not a neurosis. He studied the families of 1,112 individuals having asthma, hay fever, hives or angio-neurotic edema and he used patients with chronic bronchitis as controls. He predicted that, if asthma is really a neurosis, more of his cases would be found in the so-called vulnerable positions in the family than would otherwise be expected. He actually found that allergic disease is more frequent in the oldest child and in the youngest of a large family, but all the other vulnerable positions had no higher incidence than might be expected from mathematical chance. The author concluded, therefore, that allergic disease is not a neurosis and he explains his findings by stating that the oldest and youngest children are most likely to be over-fed,—hence the presence of allergic diseases!

In our series of fifty cases we know the position in the family of each patient. One of our cases was the second born, but from the age of three weeks was reared by a cousin as an only

child, so this patient is excluded, leaving forty-nine patients. Since the average size of all the families is four and nine-tenths children, one would expect to have ten patients in each position in the family. Our group of forty-nine showed that there were actually sixteen first born and fourteen youngest children. That is approximately fifty per cent more than the expected number of oldest and youngest children. For all the other positions in the family twenty-nine would be the expected number but there are remaining only nineteen. Of course no conclusions should be drawn from such a small series, but since the results agree essentially with those found by Haag in his large series they take on an added significance.

Haag's conclusion that over-feeding explains the higher incidence of allergic diseases in the first-born and in the youngest of a large family seems unwarranted. There is no evidence that over-feeding is a cause of allergic sickness, nor is there any evidence that the first-born and the youngest child are over-fed and the only child is not. It seems to us that the author presents significant evidence that allergic diseases do have a psychic component. What is needed, however, is a careful statistical study of neurosis in a large group to determine whether the Individual Psychologists are correct when they say that certain positions in the family are more vulnerable than others. There were no "only-children" in our group. Haag found "only-children" relatively immune from asthma, but Rogerson (16) found many "only-children" in his group of cases. Among our forty-nine patients we labelled twenty-nine as being neurotic and twenty as being normal. Eleven first-born were neurotic and five were normal. In all other positions, including the youngest, the proportion of neurotics and normals was equal. We reiterate that our series is

too small to be used statistically but tentatively one might say that there seems to be a trend toward a higher incidence of asthma and of neurosis in the first-born.

FEAR OF WATER

In 1922 at the Vienna Psychoanalytical Society, Felix Deutsch (3a) reported a case of asthma where fear of water and other fluids was an important determinant of the respiratory neurosis. He has since observed a similar mechanism in other patients. Strauss (18) reports the case of a patient who developed asthma shortly after an unhappy experience in the water and another one of his patients was frequently bothered by dreams of drowning. Also, Hanse (8) tells of two patients whose asthma seemed to have been precipitated by great fear of the water. Each patient in our group of fifty was asked if he liked the water, and if he had ever had any frightening experience in the water. Forty per cent said that they had fear of water; in the "emotional group" forty-seven per cent said they had this fear. Surgical patients of similar age and sex were used as controls and in only twenty-six per cent did we obtain a positive answer to our question concerning the presence of such a fear. Forty-four per cent of the entire series and fifty per cent of the "emotional group" had had some particularly frightening experience in the water, but among the control group only thirty per cent had had any such experience (see Chart IV). Of the fifteen patients in the "emotional group" who had a frightening experience in the water, eleven suffered the experience before the onset of the asthma. It might be thought that the fear of water in these cases is simply an expression of a neurotic character, but in our series this is not the case for there is

little correlation between those patients labelled neurotic and those having fear of water.

ALLERGIC COMPONENTS

One of our patients, a woman of fifty-two years, suffers from asthma every winter and spring and during

HISTORY OF FEAR OF WATER
IN 50 ASTHMATICS AND 50 CONTROLS.

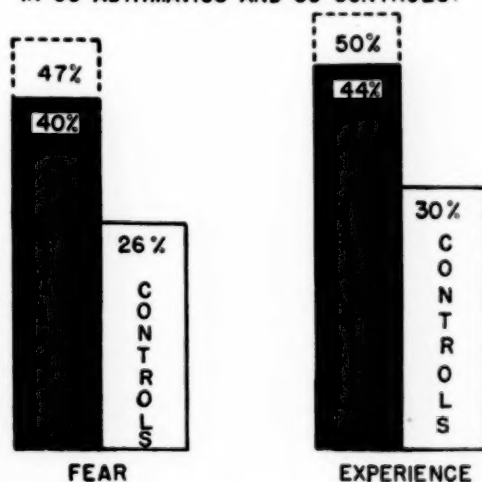


CHART IV. In this chart the observations on the controls were made in the same way as those depicted in Chart III.

this period attacks are precipitated by emotional upsets. During the summer and fall, however, which is her free period, these same emotional upsets will not initiate attacks. It might be assumed that a purely allergic asthma would be more likely to be seasonal than one having psychic factors. In our series the "non-emotional group" has no more seasonal cases than the "emotional group." Dekker (2) and others have stressed the point that emotional conflicts cannot affect a patient's asthma unless the allergens are present. Ziegler and Elliott (22) seem to infer that one must look for psychic factors in asthma only in those cases with negative skin tests and Wittkower and Petow (21) apparently look upon

negative skin tests as evidence of a psychic asthma. In our series sixty-eight per cent show positive skin tests and there is but little difference in percentage between the "emotional" and "non-emotional" groups. Maxwell (13) found in his allergic cases that the asthma had an earlier onset than in his

relief from operations on the nose. He stresses the importance of suggestion in the whole atmosphere of the allergy clinic. The new patients are affected by the cured and improved patients and there is considerable suggestion in the reports going through the clinic that after so-and-so many injections, one will be improved and finally cured. Reichmann (4) and Wittkower and Petow (21) also believe that the usual somatic therapy really obtains its re-

NERVOUS HEREDITY IN THE 2 GROUPS

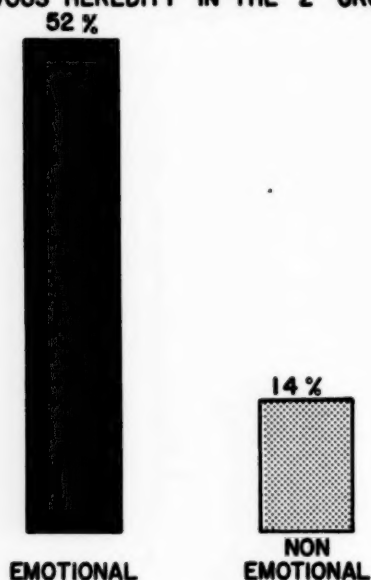


CHART V. Patients who told us that their immediate relatives had shown unusual behavior, had been inmates of mental hospitals, or had shown marked emotional instability were classified as having "nervous heredity". It is obvious that in the "emotional group" there were many more than in the "non-emotional group".

psychological cases, but in our cases the age of onset in the "emotional" and "non-emotional" groups was about the same.

THERAPY

In the review of the literature, mention was made of several workers who report good results in asthma cases from the use of psychotherapy. Naber (4) is of the opinion that allergic treatment improves patients chiefly through its psychic influence; he states particularly that few asthmatics obtain any

PATIENTS' OWN ESTIMATE OF BENEFIT FROM SOMATIC TREATMENT

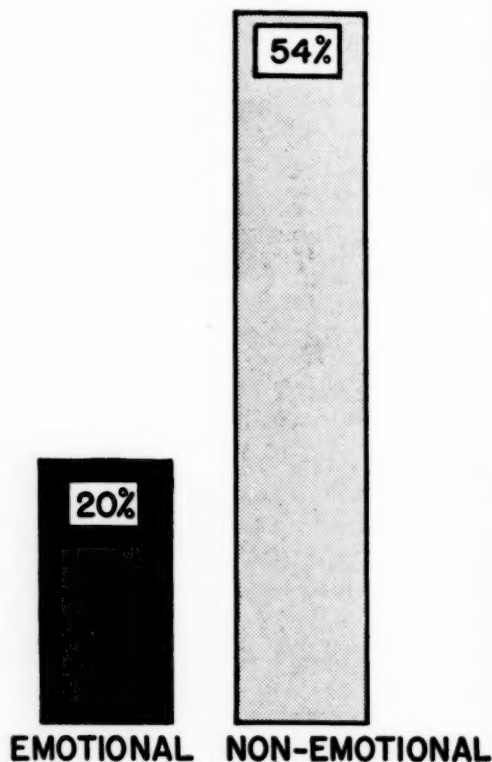


CHART VI. Those patients who reported that they had had definite benefit from treatment by drugs and biological preparations are counted as "benefited by somatic treatment". It is of interest that in the "non-emotional group" a much higher percentage were improved by such therapy, indicating that suggestion is not a large element in the success of somatic treatment.

sults chiefly through its psychotherapeutic effect. The latter authors think that the success of the treatment, regardless of its nature, depends to a great extent on the personality of the physician. Dekker (2) agrees that allergic therapy seems to be partly suggestion and in this way he explains the success of many quacks. He adds that the improvement often seen in patients as soon as they enter a hospital can partly be explained on the basis of the hope it gives them. In the same way, the frequent success for a short time of almost any new type of treatment can probably best be understood as psychological.

With our series of patients we tried to determine in a general way how much benefit they had gained from somatic therapy. We obtained only the opinions of the patients themselves. Their treatments included all medical and surgical procedures that were carried out in an attempt to alleviate their asthma. In the "non-emotional group" fifty-four per cent received more than slight benefit and in the "emotional group" only twenty per cent obtained more than slight relief. This suggests (although the number of cases is small) that somatic therapy is more successful in the "non-emotional group". It would seem that the "emotional group" would have benefited more if there were a large element of suggestion in the somatic therapy. Also, it is of interest to note the effect of the somatic therapy on the patients labelled neurotic and non-neurotic respectively. In twenty-seven neurotic patients, on whom the effect of the treatment is known, only five obtained more than slight relief, but in twenty non-neurotics ten received more than slight benefit. Here again the general trend appears to show that somatic therapy is not chiefly suggestion since neurotic persons are usually considered to be quite suggestible.

SUMMARY

Fifty cases of bronchial asthma were taken from the allergy clinic without selection and were studied psychiatrically by means of one or two interviews.

a) Thirty-seven of the 50 cases seemed to have an emotional component in their asthmatic attacks.

b) The thirteen "non-emotional" patients were predominantly young males.

c) Twenty patients reported that the first attack was emotionally precipitated.

d) Thirty-one reported that later attacks were often emotionally precipitated.

e) Thirty patients showed neurotic traits (other than asthmatic) usually of a compulsive character.

f) Only 20 per cent of the "emotional group" were benefited by somatic therapy, while 54 per cent of the "non-emotional group" were benefited. Likewise in the "neurotic group" only about 20 per cent were helped by drugs and biological products, while 50 per cent of the "non-neurotic group" were helped.

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APPENDIX

Below are listed the summaries of the case histories of the fifty patients studied. The first group consists of those cases in which emotional factors were discovered, then comes the group in which the emotional factors were questionable, and last are listed those cases showing no apparent psychic factors. After each case history are certain letters which designate the presence or absence of emotional factors and also the relationship between the emotional disturbance and the attack. The meaning of each letter employed is explained in the following code:

A—asthmatic attacks are not precipitated by emotion.

B—asthmatic attacks are questionably precipitated by emotion.

C—asthmatic attacks are apparently precipitated by emotion.

D—asthmatic attacks, once started from whatever cause, are apparently made worse by emotion.

E—asthmatic attacks, once started from whatever cause, are not made worse by emotion.

F—asthmatic attacks, once started from whatever cause, are apparently improved by emotion.

G—first attack patient ever had was apparently precipitated by emotion.

H—first attack patient ever had was questionably precipitated by emotion.

For instance, case No. 4 is given a rating of C D H. This means that the patient's asthmatic attacks are precipitated and also aggravated by emotional disturbances. In addition, the first attack she ever had was questionably precipitated by emotion. The cases in which no psychological factors were discovered are rated as A E.

SUMMARY OF CASE HISTORIES

POSITIVE CASES

Case	Hospital Number	Rating
1	18,812	AD
2	27,335	CE
3	7,920	ADG
4	43,534	CDH
5	335,730	CE
8	2,111	CEG
11	5,729	CEG
17	5,367	CEH
18	27,661	CE
20	9,470	CD
22	30,099	CE
23	15,967	CEG
25	55,087	AD
27	12,428	CEFG
28	414,094	CE
29	48,978	CD
32	21,100	CEH
34	7,922	CDH
36	20,074	CDFH
37	52,362	CEG
38	36,758	CD
39	27,672	BD
40	36,520	CEG
42	5,400	CEG
44	3,096	CE
45	39,026	AD
46	44,715	CEH
47	5,380	BD
48	31,105	CD

QUESTIONABLE CASES

Case	Hospital Number	Rating
6	55,890	A E H
13	7,925	B E
15	11,559	B E H
16	24,734	B E H
19	257,254	B E
30	30,332	B E H
49	12,594	B E H
50	380,121	B E H

NEGATIVE CASES

Case	Hospital Number	Rating
7	46,986	A E
9	32,677	A E
10	6,419	A E
12	12,166	A E
14	19,845	A E
21	53,624	A E
24	47,520	A E
26	6,372	A E
31	46,746	A E
33	3,394	A E
35	8,024	A E
41	2,123	A E
43	10,424	A E

POSITIVE CASES

(Those in which the emotional factors seemed significant to the examiners)

CASE NO. 1 M.G.H. #18812 CODE RATING A D

This thirty-four year old single electrician's helper has suffered from asthma since the age of eight years. The attacks were quite severe until he was fifteen years old when they improved, but since the patient had pneumonia at twenty-four years they have become severe once more. Attacks occur at any time of the year but occur more frequently before a rain and improve when the weather clears. When he is around animals he will sneeze and will occasionally have an asthmatic attack. Overexertion will also cause wheezing. When he becomes excited or frightened his whole body trembles and he perspires freely but an attack is never precipitated. However, at the time of his brother's death, which occurred under unusual circumstances, he remembers that he had asthma and that he became worse at that time. Skin tests are positive for cat hair,

dog hair, chicken feathers and house dust. X-rays of the nasal sinuses are negative. He has had slight improvement from tonsillectomy and from the use of ephedrin and potassium iodide but only questionable benefit has resulted from vaccines. He has been bronchoscoped several times and he believes that this procedure has helped considerably.

In 1931 a brother died and murder was suspected. One sister is nervous and another is a severe cripple. A brother has asthma. The patient is the youngest of seven children. He had nightmares during childhood, did not walk until the age of three years and has bitten his fingernails all his life. Because of his asthma he was taken out of school at the age of eleven years. He soon started to work as an errand boy, later became an electrician's helper but on account of his illness he has worked very little since 1928. He is single and has not married because he has not even been able to support himself. He had the usual childhood diseases, double pneumonia in infancy and lobar pneumonia at twenty-four years. For the past ten years he has had trouble with his stomach and five years ago a diagnosis of duodenal ulcer was made.

He has always been nervous. He is extremely neat and quite punctual but is not particularly cleanly. He does not swim well but is not afraid of the water and has never had any frightening experiences in the water.

CASE NO. 2 M.G.H. #27335 CODE RATING C E

This twenty-nine year old Italian-born housewife commenced to smoke cigarettes to excess at sixteen years of age and a month later developed a cough and asthma. The asthma has been worse in the winter-time and is usually preceded by a cold. She will commence to wheeze if she overexerts herself or if she is nervous and uneasy but nervousness alone will never bring on a "real attack". Although she blames smoking for her asthma, only during the past month has she stopped smoking and her asthma has been better. Skin tests were not done and she has never had any particular treatment for her asthma.

The mother had diabetes and is nervous. One sister is nervous and stubborn. A brother is quite dull in school. Eight siblings died shortly after birth. The patient was born in Italy and came to this country at seven years of age. She said she was a hard baby to wean and was more than two years of age when she was taken off the breast. She has bitten her fingernails all her life. She finished the sixth grade of school at fifteen years, was kept back one year and was finally expelled from school because she was a disciplinary problem. At home she got on fairly well with her siblings but she says that her youngest sister was the father's favorite and she believes that she got less attention and more punishment than the other children. She went to work in a shoe factory at fifteen, stopped working at twenty-two years, but due to poor financial circumstances, she returned to work a few months ago. She married at seventeen years, more in order to get out of the unhappy home situation than because of love for her husband. There is one child aged eleven years. Coitus has always been painful, her orgasm usually occurred but since she has been suspicious of her husband going out with other women during the past year she has been entirely frigid. She has always had frequent colds. Tonsillectomy was done nine years ago. In March 1937 a cervical abscess was incised and drained and a month later she developed rheumatoid arthritis.

She has always been happy-go-lucky but somewhat sensitive. She has not been particularly orderly or clean and is not punctual. She cannot swim, is a little timid about the water and says she gets nervous "just looking at a canoe". At the age of seventeen years she was thrown into the water, was frightened and "got her head full of water".

CASE NO. 3 M.G.H. #7921 CODE RATING
A D G

This thirty-nine year old Jewish housewife has suffered from asthma since 1925. In that year a policeman announced to her that her husband had been killed in an accident but he immediately corrected himself, saying that he had only been in-

jured seriously. She was quite upset at the time and about a month later, while her husband was still in the hospital, she had her first attack of asthma. She received some treatment at the time and after two months had no more trouble until April 1934 when the attacks returned and again treatment was of benefit. However, in September 1935, her asthma returned and has continued to the present time, being worse during the cold weather and often occurring early in the morning and after exertion. She also believes that her asthma is worse when she is nervous but this is not very marked. In May 1935 she moved but she did not like the new neighborhood and she believes she would improve if she could move back to her old home where she would have her sister as a neighbor. Skin tests are positive for ragweed, redtop, horse hair, dog hair, kapok, chicken feathers, orris powder, milk, beans and house dust but the reactions are not particularly marked in any of these. During this last period of asthma, since September 1935, she has had many vague symptoms such as fatigue, weakness, nausea and irritability and it is apparent that she is now going through her menopause.

Father, a paternal uncle, two paternal aunts and a paternal cousin all have asthma. The mother and two siblings are rather nervous. The patient was the eldest of three children. She was sickly as a child, had many nightmares and she believes that her mother was not very devoted to her. She finished high school at eighteen years and then worked as a stenographer until her marriage six years later. She was married at twenty-four years of age and she states that she knew nothing at all about sex until after her marriage. There are two children and coitus interruptus has been practised as a contraceptive measure. She had the usual childhood diseases as well as diphtheria. She had scarlet fever at sixteen years of age. Her second child was born by Caesarean section. For the past eighteen months her menstrual periods have been irregular and scanty.

She thinks she has "an inferiority complex" because she has no confidence in her-

self and is not very self sufficient. She is very orderly, clean and fussy about her home and she must never see her house in disorder. She is not particularly punctual. She can swim and has no fear of the water. When twenty-two years old she had a moderately frightening experience in the water.

CASE NO. 4 M.G.H. #43534 CODE RATING
C D H

This thirty year old married woman commenced to have frequent colds and symptoms of sinusitis at twenty-three years of age. Shortly after this she had her first asthmatic attack. It was during this period that she was not getting on well with her husband and a year after the onset of the asthma they were divorced. Her attacks continued, came on particularly in cold weather, were often preceded by colds and occasionally were precipitated by exposure to cold air. Three years after her divorce she remarried and was free from asthma for about a year but then her attacks returned with severity. Her second husband was quite attached to his mother and could not satisfy the patient sexually and she believes that this has something to do with the exacerbation of her asthma. Also, her first husband married her own sister and this upset the patient a great deal. From March 1936 until February 1937 she spent most of the time in the hospital. Her asthma was extraordinarily severe and at times she had to be put on the "danger list". Heroic measures were necessary to control the attacks, Large doses of paraldehyde, ether per rectum, intravenous adrenalin in glucose and an oxygen tent were resorted to. Several times plans were made to discharge her but as soon as she learned of the plans she developed an attack severe enough to make necessary the use of the heroic measures mentioned above. Also, if she became nervous or worried during an attack she would become worse. The physicians on the medical service of the hospital easily recognized the large emotional factors in this case and she was finally transferred to the psychiatric service for psychotherapy. She gradually improved and after eight

weeks of treatment she was able to go home and soon it was possible for her to work as a stenographer. Skin tests are negative except for slightly positive reactions to kapok, chicken feathers, dog hair, milk and house dust. In 1935 a nasal polyp was removed and her asthma was greatly improved for several weeks. X-rays of her nasal sinuses showed infection and a sub-mucous resection of the nasal septum was done with little benefit. She has obtained some relief during attacks from adrenalin, asthma powder and large doses of sedatives. Potassium iodide and belladonna seem to help slightly.

A grandfather had asthma; there is no family history of nervous disease. The patient was the oldest of five children. She married at seventeen years, was divorced at twenty-four years and remarried at twenty-seven years. She has three children living and well. She had the usual childhood diseases. She had a tonsillectomy sixteen years ago and an appendectomy fifteen years ago.

The patient is inclined to be irritable and usually whines when things do not go well. She is inclined to be rather neat, cleanly and punctual. She has no conscious fear of the water but she has frequent terrifying dreams about the water and in each dream she is about to be drowned. However, no actual frightening experience in the water is known.

CASE NO. 5 M.G.H. #335730 CODE RATING
C E

This forty-two year old married woolen mill worker had some vague difficulty in breathing about ten years ago but he says that this was not asthma and that he was cured completely by tonsillectomy. Seven years ago, following a cold, he had his first definite asthmatic attack. Since then he has had frequent nasal obstruction with sneezing, usually starting in August and lasting a month. Since 1932 his asthma has been worse, attacks usually follow colds and during the past five years he has had to be hospitalized four different times. Two years ago he had "septic sore throat" which seemed to improve his asthma for a time. He will commence to wheeze if he becomes

annoyed with his children, if he argues with his wife, if he becomes excited playing cards or if he becomes nervous for any reason. However, when his daughter died in 1933 and his wife had a severe operation in 1934 he noted no change in his asthma. Skin tests are only suspicious for cat hair, kapok, orris powder and house dust. In 1934 nasal polyps were removed and at the same time x-ray of his nasal sinuses showed pathology. Attacks are helped by the use of ephedrin and adrenalin.

Family history is negative for allergy; one sister is nervous and worrisome. Patient was the youngest of five children. When thirteen years old he lost an eye in an accident and quit school. He always has been sensitive about this eye, has tended to keep to himself for this reason and as a boy he was called "One Eye" by his associates. He went to work at fourteen years and most of his life he has worked in a gun shop in which he was foreman. He took the responsibility of this position very seriously and worried about it a great deal. His shop closed down seven years ago and he has done very little work since then because of illness. About five years ago he was in great financial straits, "was down to his last two dollars and was going on the welfare the next day", on the following day he had swollen tender joints and he has had arthritis ever since. In infancy he had eczema. At twenty-two years of age he had gonorrhea complicated by arthritis. He was married fifteen years ago, has two living children one of whom is nervous and excitable. His libido has been diminished during the past four years.

He is inclined to be very orderly, neat, cleanly, meticulous and punctual. He can swim very little, is quite frightened of the water and when he was about eight years old he "almost drowned".

CASE NO. 8 M.G.H. #2111 CODE RATING
C E G

This forty-six year old housewife has had hay fever for the past fifteen years. She was married at twenty-eight years, her husband being six years her junior. Soon after the marriage her husband commenced to go out with other women and

was indifferent towards her. Eight years ago he became ill, was paralyzed on one side of his body and a few months later a diagnosis of central nervous system syphilis was made. When she learned this diagnosis she was very much upset emotionally and at that time had her first asthmatic attack. She believes that "nerves" is the cause of her asthma. Whenever she gets nervous or excited for any reason she has a feeling of tightness in her chest, wheezing will appear and then she will have a typical asthmatic attack. She will have an attack under the following circumstances: if she becomes angry, if she hears of anything particularly exciting, if she overexerts herself, if she is worried about money matters, if she knows that her husband is going to visit her, if she uses face powder, if she eats fried clams or if there is very much dust in the air. A few months ago when she first planned to divorce her husband the asthma became definitely worse. When her mother died four years ago she was quite upset but she does not remember that her asthma changed any. Skin tests are positive for timothy, redtop, orris powder, goose feathers and house dust. Staphylococcus and dust vaccines, as well as injections from the preparations of the grasses, have been of no definite benefit. Adrenalin helps a great deal during attacks.

A sister has hay fever and five years ago she was depressed and was in a mental hospital. Patient was the youngest of three sisters. Her father was a drunkard, very strict and disagreeable and his children feared him. She finished grammar school at thirteen years, then worked in different factories but finally took nurses training, graduating at twenty-six years of age. She worked as a nurse for several years after her marriage. As mentioned above, her marriage was not very happy. There are three children one of whom formerly had hay fever and another has had a "nervous breakdown". She had the usual childhood diseases. She had a suspension of the uterus at seventeen years, influenza in 1919, operation on her nose at twenty-five years and she has had abdominal distention and gaseous eructation. For the past eight years she has had hives about four times a year.

She has always been somewhat nervous and the nervousness has been more marked in the past seven years. She thinks she is more orderly and cleanly than the average woman and is inclined to be quite punctual and conventional. She likes good food, talks a great deal about foods and recipes and delights in attending cooking schools. She is afraid of water and has never learned to swim. When she was six years old she was taken into the water and was "going down for the third time when she was pulled out".

CASE NO. II M.G.H. #5729 CODE RATING
C E G

This twenty-eight year old single stenographer has always suffered from frequent colds and at fourteen years of age she developed symptoms of sinusitis. She was never very happy at home, was particularly antagonistic towards her father and her older brother, the only sibling, was her only confidant. When she was seventeen years old and her brother went off to college leaving her alone in the unhappy home situation, she had her first attack. At nineteen years of age she developed bronchitis and her asthma became more severe. The following year she had an operation on her antrum, her asthma was improved and for the next eighteen months she was bothered with wheezing only. At twenty-two years of age she developed pneumonia, after this the attacks were very severe, adrenalin lost a great deal of its efficacy and her physician gave her pantapone. This severe spell of asthma had its onset about six months after her brother's marriage. At the time she was too sick to work. At twenty-five years she had pneumonia again. At this time peptone injections were given and she was free from asthma for six months. The spells came on at any time of the year, seem to be worse in cold damp weather and usually follow a cold. When she becomes emotionally upset for any reason, particularly when she is irritated by her grandfather, she will have an attack. There is only a questionable relationship between her asthma and a broken engagement, and the relationship between the sickness and death of her mother and her asthma is not definite.

The maternal grandfather is a domineering, cold, severe type of person; the maternal grandmother was high-strung and nervous. The father is quick-tempered and the mother was always nervous and irritable. The patient was the younger of two children and the only girl. As a child she had temper tantrums. She graduated from high school at the age of sixteen years and then went to work as a stenographer. At nineteen years she became engaged but broke the engagement because of differences in religion. A year later she became engaged but a few months later broke this one off too because he did not come up to her expectations. Three years ago she became engaged for the third time and plans to be married as soon as her health permits. She had measles during childhood, nasal polyps removed at sixteen years, operation on her antrum at twenty years and "appendicitis" without operation at twenty-seven years. She had amenorrhea from 1932 to 1934 and her menses stopped again in 1936 and have not yet returned.

She says she is usually happy but has occasional blue spells. She has some intellectual interests and spends considerable time reading. She is inclined to be overly neat, cleanly and punctual. She has never learned to swim but likes the water and is not afraid of it at present. However, at twelve or thirteen years she became quite frightened in the water, had to be helped out and refused to go into the water again for over a year.

CASE NO. 17 M.G.H. #5367 CODE RATING
C E H

This fifty-four year old married factory worker has had a chronic cough most of his life. In 1932 he was injured at work and when he was able to return to his job he was given a poorer position and subsequently commenced to have financial worries. He had his first attack during this period of worry. Attacks usually start upon waking in the morning and they are more frequent during cold damp weather. An attack will be precipitated if he worries about anything, particularly about money, if he becomes angry or if he overexerts himself. During an attack he has considerable fear of suffocation. Skin tests are nega-

tive. He has obtained very little help from vaccines or adrenalin. In 1934 a diagnosis of stenosis of the right middle lobe bronchus was made.

A paternal aunt had a "nervous breakdown"; there is no family history of allergy. As a child the patient vomited frequently at night. His mother died of diphtheria when he was three years old. His father remarried and he never got along well with his step-mother. He completed the first year of high school, then took a short business course and went to work at the age of sixteen years. He has done many different types of work, chiefly in factories, but has been unable to find employment during the past four years. He was married in 1913. His wife is nervous and irritable and there are many arguments. Four children are living and well. He had the usual childhood diseases as well as diphtheria at three years of age and pneumonia at fifteen years.

Nothing unusual was learned about his personality. He has never been a fussy or particularly cleanly person but he is punctual all the time. He likes to swim and has no fear of the water.

CASE NO. 18 M.G.H. #27661 CODE RATING
C E

This fifty year old housewife developed hay fever in her third decade and the attacks occurred in the spring and summer. Four years ago her hay fever became more severe, she developed a cough and occasionally wheezed during the hay fever season. However, she says that her asthma did not start "in earnest" until September 1936. Since then she has had an attack almost every night, has a great deal of cough and sputum and she tells that she "retches" as she did during her pregnancy. Attacks are more likely to occur when she is tired or emotionally upset and she remembers one instance when she had an attack while an unwanted visitor was at her home. During an attack she feels ashamed of the way she coughs and breathes and does not like anyone to see her. She believes that she is sensitive to aspirin and that this drug will cause asthma. Since July 1936 her menses have been scanty and irregular, she has had some hot flashes and since this time

she has been more nervous than usual.

An uncle and a daughter have hay fever. The mother died when the patient was three weeks old, she was adopted by a cousin and had a happy childhood. When young she had nightmares and walked in her sleep. She finished the first year of high school at fourteen years and then did office work until her marriage. She was married at thirty-three years and has two daughters one of whom is shy, quiet and seclusive. Patient's past health has been good. All her life she has noticed that a welt will appear whenever her skin is scratched.

She has always been a little nervous. As a child she was self-conscious, shy and bashful and because of this she had some difficulty reciting in school. She is not particularly orderly or cleanly but is always punctual, proper and conventional. She is afraid of the water, has never learned to swim but has never been frightened in the water. She worries about her daughters when they are away, particularly if they have gone swimming.

CASE NO. 20 M.G.H. #9470 CODE RATING
C D

This thirty-six year old married taxi-driver has had asthma for the past fifteen years. Attacks are more frequent in cold weather, usually follow colds and at times during the winter an attack will clear up if he goes into a warm place. He believes that cheese, tomatoes, bananas, feathers and dust tend to give him attacks. After an operation on his nose in 1921 he had no asthma for about four years. In 1928 he commenced to have hay fever in the late summer and fall and his asthma became worse, particularly during these months. Asthma powder and adrenalin have helped during attacks, vaccines have been of questionable benefit but ephedrin and potassium iodide have made no improvement. However, his hay fever has been improved by treatment. If he becomes nervous or emotionally upset, for instance when he is worried about a bill he cannot pay, an attack will be precipitated. Also he has noticed that if he becomes annoyed or irritated during an attack the attack will

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become worse. Skin tests are positive for ragweed, chicken feathers, kapok and house dust and slightly positive for orris powder and cotton seed.

Both parents and an older brother are nervous. The father has hives and the mother has arthritis. A paternal uncle is in a state mental hospital, his psychosis appearing after a head injury. As a child the patient was always in trouble because of his many minor misdemeanors. He was dull in school, quitting at eighteen years while in the sixth grade. He has worked most of his life as a taxi-driver but had to give this work up two years ago because the outside work in winter time caused his asthma to become worse. He has been married for eleven years and has three children, one of whom has hives after eating strawberries. Coitus interruptus has been practised for the past two years. The patient's general health has been good except for his asthma.

He is obviously mentally deficient. He is quite cleanly and punctual and, in addition, is fussy—"everything must be just so". He swims, has no fear of the water and never has been frightened while in the water.

CASE NO. 22 M.G.H. #30099 CODE RATING
C E

This forty-six year old married laborer has suffered from asthma since the age of five years. It is present all the year around to a certain extent but is worse in September, October and during cold weather. Attacks usually start in the early morning and he has a little wheezing almost every morning. Excessive smoking, greasy foods, overeating, overexertion and the presence of feathers, dogs, cats and horses all tend to cause attacks. His most recent job is quite dusty and this causes wheezing. Whenever he gets angry he will choke up and wheeze but he noticed no difference in his asthma at the time his mother and brother died. Skin tests are positive for ragweed, horse hair, dog hair, chicken feathers and house dust and are questionable for several other substances. He has obtained a little relief with vaccines and potassium iodide.

The father has asthma, the sister has

questionable asthma and it is believed that some of his paternal uncles and aunts also had asthma. The mother had hives and was nervous. A brother was nervous and a periodic drinker. Another brother died of tuberculosis and had questionable hay fever. Still another brother, who had enuresis until the age of twelve years, disappeared mysteriously several years ago. Another brother was a morphine addict and committed suicide by hanging. A sister is nervous. The patient was the third of eight children. After finishing the seventh grade of school at thirteen years of age he went to work, has done different kinds of work chiefly of the laboring type. Until two years ago he was a heavy drinker of alcoholic liquors. He was married ten years ago, there are no children and he and his wife have been separated for the past five years. He had the usual childhood diseases and typhoid fever at sixteen years. He had frequent colds and sore throats before tonsillectomy at twenty-five years. He suffered from occasional fainting spells while drinking heavily.

He says he is fussy and neat, *i.e.*, the sugar bowl must be covered and the milk bottle must be in its proper place, etc. He also is rather cleanly and quite punctual. He cannot swim, is afraid of water and when he was about fourteen years old he "almost drowned".

CASE NO. 23 M.G.H. #15967 CODE RATING
C E G

This fifty-two year old Irish-born housewife developed a chronic cough during the winter three years ago. One day, the following spring, she was told that her sister-in-law, of whom she was quite fond, was seriously ill and was not expected to live. She was quite upset and while she was rushing along the street to visit her friend, she had a bad fit of coughing with difficulty in breathing. She went to her doctor's office immediately and he told her that she was having an asthmatic attack. Since then she has had attacks in the winter and spring, but has been relatively free in the summer and fall. If she becomes worried or upset about anything, particularly if she hears about a death, she will have an asth-

matic attack. She believes that worry about her husband's unemployment and about his excessive drinking has made her asthma worse. In addition, she says that saying her rosary helps a great deal. These emotional factors will not precipitate attacks in the summer and fall which are her relatively free periods. Skin tests are positive for ragweed, feathers and house dust. In 1928, before the onset of her asthma, pansinusitis was diagnosed by x-ray and a radical antrum operation was done the following year. In February 1936, x-ray showed slight broncho-pneumonia. Potassium iodide and epherdin as well as staphylococcus and streptococcus vaccines have given only questionable improvement.

A sister has hay fever, a brother has asthma and two other brothers have rheumatism. The patient was born in Ireland and came to this country twenty-six years ago. She was the seventh of nine children and suffered from frequent attacks of vomiting during childhood. She started school at eight years and finished the eighth grade at sixteen years. Before her marriage at twenty-eight years she did house work. There is one living child aged twenty-four years. Past health has been fairly good. Nasal polyps were removed seven years ago and six years ago she was operated upon for a "tumor on her womb". She had her menopause nine years ago.

Nothing remarkable was learned about the patient's personality. She is quite orderly, cleanly and punctual. She is frightened of the water and does not know how to swim but has had no unhappy experiences in the water.

CASE NO. 25 M.G.H. #55087 CODE RATING
A D

This thirty-five year old housewife had her first attack of asthma in 1935 following a cold and sore throat. The attacks are most frequent in the spring and in damp weather but mild attacks occur at any time of the year. Seven years ago she commenced to have frequent attacks of discharge from the nose accompanied by watering of the eyes occurring usually in February, March and April. When she is in an attack of asthma an emotional upset will make the attack worse but she has

never noticed that nervousness ever precipitated an attack. The spells are often brought on by the presence of dust and cold air and by overeating and overexertion. Skin tests are negative. Adrenalin is of considerable benefit during attacks and she obtained temporary relief from an antrum operation a year ago.

There is no family history of allergy or nervous disease. The patient was born in Ireland, came to this country at twenty-one years of age. She was the third of four children. She quit school in the sixth grade at the age of fourteen years and worked as a maid until her marriage. She was married at thirty and has one child, aged four years, delivered by Caesarean section. Her past health has been very good. She has had hives all her life and influenza in 1918.

She is inclined to be neat and clean but these traits are not marked. She is not particularly punctual. She cannot swim, does not like the water but does not consider herself afraid of it.

CASE NO. 27 M.G.H. #12428 CODE RATING
C E F G

This thirty-one year old single unemployed gardener, had whooping-cough at three years of age and each fall after this he had bronchitis until the age of thirteen years. At fourteen years, after an attack of influenza, he became nervous, excitable and had a fear of crowds. When he was eighteen years old and was working at a job he did not like, his nervousness increased and he had his first attack of asthma. The asthma is not very severe, the attacks occur at any time of the year but tend to be more frequent in the late summer and early fall. Whenever he becomes upset emotionally or nervous for any reason, he will commence to wheeze and will often have a real asthmatic attack. He suffers considerably from sexual conflicts and has many psychoneurotic symptoms. He has periods when he becomes increasingly nervous and he explains this by saying it is due to his fighting against the desire for masturbation. Immediately after he masturbates he feels tense and "jittery", has tremor of the head, palpitation of the heart and a vague feeling of fear, and he

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feels "just as if he had been given some adrenalin". Whenever he masturbates while he is having an asthmatic attack the attack will entirely disappear. Skin tests are negative, vaccines have been of no benefit but small doses of adrenalin are helpful in an attack.

A paternal uncle has asthma. The maternal grandfather, mother, two maternal uncles and aunts and two sisters are all nervous, irritable and high-strung. The patient was the youngest of three children and the only boy. He has always been over-protected and even today is treated as a child at home. He finished high school at seventeen years, worked for awhile as an office boy but had to give up his job one year later because of nervousness. Later he worked on a poultry farm, then attended an agricultural school and has worked as a gardener, although he has not had very steady employment. He is single has had no heterosexual experiences and he still masturbates. Past medical history includes tonsillectomy at twelve years, influenza at fourteen years, repair of inguinal hernia at fourteen years and he has always had frequent colds. He has always noticed that whenever his skin is scratched a welt will appear.

He has been nervous most of his life. He is sensitive, excitable, high-strung, does not make friends easily and has had some difficulty making a good adjustment away from home. He is not particularly orderly or cleanly but is usually quite punctual. He swims poorly and is rather timid about the water. When he was five years old his older sister threw him into the water, he went under once and was quite frightened.

CASE NO. 28 M.G.H. #414094 CODE RATING C E

This thirty-five year old Russian-born Jewish housewife had her first attack of asthma when fourteen years old about six months after arriving in this country from Russia. During the five years following the onset, attacks were mild but occurred about three times a month at any time of the year. One month after the birth of her first baby, when she was nineteen years old, she had frequent severe attacks of asthma over a four months' period and six months

later she had another long series of attacks. Since then her asthma has been somewhat worse during cold weather. Eight years ago her second child, a daughter, was born and the child had a harelip. After the birth the patient became quite upset, was frightened, said that it was not her baby and she did not want it. After two weeks in the hospital she went home, was ashamed to have her friends see the harelip and at this time her asthma reappeared with severity and lasted for several weeks. Whenever she is nervous or upset for any reason, such as when her husband scolds the children too much, she will have an attack. However, she adds that she will often commence to wheeze for no apparent reason. Her asthma was definitely worse after pneumonia in 1924 and 1932. Skin tests are negative. Vaccines, potassium iodide, belladonna, extraction of teeth and tonsillectomy did not give any improvement but adrenalin is of great help during an attack.

No family history of allergy or nervous disease. Patient was the second of four children. In this country she attended night school and finished the seventh grade. At fifteen years of age she went to work in a factory. When seventeen years old she married a Russian Gentile much against the wishes of her father, who disowned her for it. Her married life has been fairly happy and satisfactory.

She says she is ordinarily a happy person, having many friends. She loses her temper easily and is inclined to be stubborn. She is very fussy, neat and orderly about her home and is usually punctual. She has the habit of saving everything and is somewhat penurious. She is fond of swimming and has no fear of the water. When she was five years old she was thrown into the water by some children—"I was almost drowned and that is how my asthma started".

CASE NO. 29 M.G.H. #48978 CODE RATING C D

This forty-two year old Polish-born housewife has had hay fever in the late summer and fall for the past fifteen years. For the last thirteen years she has suffered from asthma, the attacks occurring at any

time of the year but more frequently in the fall and spring. She believes that overeating, overexertion, dust and being in the country are all bad for her asthma and she is suspicious of cabbage and potatoes. Nervousness and anger will not only precipitate attacks but will aggravate an attack already present. Disagreements with one of her sons particularly have this effect. She says, "If everything in the world goes well I have but little asthma; when my mind is unsettled the asthma is bad". Skin tests are positive for house dust and slightly positive for ragweed, timothy, cat hair, dog hair, wheat, cottonseed, orris powder and kapok. She received no real improvement from various vaccines but she obtained some questionable benefit by removing a dog and cat from her home. Ephedrin relieves attacks.

No family history of allergy or nervous disease. Patient was the youngest of five children. She came to this country from Poland when fifteen and she has had only two years of schooling. At the age of fifteen to twenty-nine years she worked in a cotton mill. She was married at seventeen years and has four children. Coitus interruptus has been practiced since the birth of the last child eleven years ago. Outside of asthma her past health has been quite good. Tonsillectomy was done twelve years ago and she had an operation on her nose seven years ago.

She is very orderly and neat about her house but is not particularly cleanly. However, she is quite punctual. She likes to swim and has no fear of the water.

CASE NO. 32 M.G.H. #21100 CODE RATING
C E H

This forty-nine year old single clerk had "bronchial trouble" in childhood. Eight years ago she commenced to have hay fever in August. In January 1933 her father died after a long illness during which she had nursed him for several months. After the father's death, the mother became ill and the patient had to take care of her. In December 1933 she had her first attack, eleven months after her father's death, and during the period when she was nursing her mother. In March 1935 her mother

died, she felt all alone and her asthma became worse at this time. However, about a month later she had an operation on her nose which definitely improved her asthma. For the past two years the asthma has been more severe, occurring almost daily, and during this period she has been hospitalized four times. Attacks are very likely to occur after a cold and after taking aspirin, and she believes attacks are more severe during her menstrual period. On account of her parents' sickness and now because of her own illness she has been unable to carry on with her clerical position and has, consequently, been under financial strain. If she becomes nervous and upset for any reason or if she is worried about financial matters she will have an attack. While she was in the hospital, she did not wish to be discharged home and the day after she was told she would be leaving soon she had a very severe attack requiring large doses of adrenalin. Skin tests are positive for ragweed, timothy and orris powder and slightly positive for chicken feathers, dog hair, redtop and house dust. Several different vaccines have given her no relief.

There is no family history of allergy or nervous disease. The patient was the eldest of four children and the only girl. She has worked most of her life as an office clerk and was the chief support of her parents. She has never been interested in men and has never married. She has always had frequent colds, had scarlet fever in childhood and in 1918 she had influenza with pneumonia. Menstrual periods are still regular but for the past year they have lasted only one day and she has had some hot flashes.

She has always had many friends, has worked hard and has been independent and self-sufficient. She was not questioned concerning specific personality traits such as orderliness, cleanliness and punctuality and she was not asked any questions concerning fear of the water.

CASE NO. 34 M.G.H. #7922 CODE RATING
C D H

This thirty-four year old housewife was married in 1926; in 1929 she became preg-

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nant and shortly after the child's birth in 1930 her husband lost his job and the family was in financial distress. In September of that year she had her first asthmatic attack. Her asthma is worse in the cold weather but attacks may appear at any time of the year. She says that dust, the presence of chicken feathers, orris powder or dogs and the odor of cooking bacon will cause attacks. She believes she is more likely to have an attack during her menstrual period. Often attacks are precipitated by nervousness and worry. Also, emotional upsets have aggravated attacks already present. At times her abdomen will become distended just before and during a severe attack and she says she "looks as if she is pregnant". When she has an attack away from home she becomes embarrassed, fears that people will take particular notice of her respiratory distress and this concern seems to make the attack worse. Skin tests are positive for ragweed, cat hair, horse hair, chicken feathers, egg white, milk, wheat, orris powder and house dust. She has received vaccines for many of these substances and they have helped moderately. She has also been benefited by covering her feather pillows and by using an orris-free face powder. An x-ray diagnosis of sinusitis has been made.

There is no family history of allergy or nervous disease. The patient was the third of five children. She finished the first year of high school at fourteen years and then found employment in a stationery shop. She was married at twenty-four years, has one child aged seven years and condoms have been used as a contraceptive measure. The patient has been separated from her husband for the past eighteen months because of his drinking.

She is inclined to be overly neat, cleanly and punctual. She cannot swim, is a little timid in the water, but has never been particularly frightened of the water.

CASE NO. 36 M.G.H. #20074 CODE RATING
C D F H

This forty-eight year old Finnish-born housewife has had asthma for the past twenty years. When she was twenty-eight years old, while she was recovering from

typhoid fever, her two year old daughter became ill with mastoiditis and she had her first asthmatic attack at that time. The attacks occur at any time of the year, but are somewhat worse in the winter. If she becomes annoyed at her husband or is upset or nervous for any reason, an attack will be precipitated. During mild attacks she keeps telling herself to be calm and happy, because she knows, from past experience, that if she becomes nervous or excited the attack may become severe enough to make her bedridden. In November 1935, skin tests were positive for timothy, ragweed, horse hair, chicken feathers, kapok, cotton seed, house dust, corn and codfish. She was put on a diet, was greatly improved and for fourteen months had no attacks at all. This was by far the longest free period she had ever had. However, in March 1937 her husband, who drinks to excess and spends more money than he ought, left home in his car and his whereabouts were unknown for three days. She became quite upset about this, did not know what had happened to him, wondered if he was in jail, or if he had possibly been killed. It was during these days of mental unrest that her asthma returned and persisted to such a severe degree that hospitalization was necessary. Her married life has never been happy, and it is her husband who usually causes the emotional upsets and worry which precipitate her asthmatic attacks. Recently she had the following dream: "I was on a boat going back to my home in Finland; I wore no clothes and noticed particularly that I had no wedding ring. I wondered what my relatives would think about this since they had all been told that I had been married all these years". The patient volunteered the following interesting information. If, during an asthmatic attack, she becomes annoyed at her husband, the attack will become worse; however, if she becomes very, very angry at him and gets into a rage the attack will disappear entirely at once.

Family history is negative for allergy and nervous disease. The patient was the oldest of five siblings. She attended school from eight to twelve years of age and then

stopped school in order to help her mother in the home. When fifteen years old she went to work in a factory and at twenty years she came to the United States and since then has done housework. She was married at twenty-five years of age and has one daughter twenty-two years old. She has had two abortions, both self-induced. She always disliked sexual relations a great deal, has been in constant fear of pregnancy, and has always been frigid. Her past health has been very good except for her asthma. Menstrual periods started to be irregular three years ago and her last period occurred in January 1937.

She has always been a simple, honest, hard-working woman and rather inclined to be nervous. She is very orderly and cleanly and if her house is not neat and clean she will not be at ease until all things are all straightened up. For appointments she is always very punctual. She can swim and has no fear of the water.

CASE NO. 37 M.G.H. #52362 CODE RATING
C E G

This thirty-seven year old, unemployed salesman was married at twenty-seven years of age. Because of her poor health, his wife was advised against having any children, and in addition, she had a good job which neither of them wanted her to give up. However, shortly after the marriage she became pregnant. The patient was quite worried and emotionally upset about it and at this time had his first asthmatic attack. During the pregnancy he was often nauseated and vomited frequently. The attacks occur at any time of the year, but he seems to be a little worse during the winter. Adrenalin helps the attacks but since he becomes frightened of the heart palpitation caused by this drug, he does not like to use it. About five years ago he was given morphine for his asthma and has gradually become addicted to this drug. About a year ago, regardless of whether he was having asthma, he was taking at least four grains a day. A few months ago, he had himself committed to a mental hospital for treatment of the addiction and since then has been taking smaller doses. During the past seven years,

he has had approximately forty hospital admissions because of his severe attacks. He believes that his chief benefit from being hospitalized derives from the quiet and rest he receives away from the many irritating factors of home. He will have an attack if he becomes nervous or excited about anything—such as worrying about paying his rent, fear of some injury to his child and excitement during a card game. He remembers that his asthma was definitely worse when his economic situation became so bad that he had to receive charity. Skin tests are positive for yeast, chicken feathers and house dust but these substances are not thought to be of much importance in his case.

A maternal uncle and a younger brother are nervous. There is no family history of allergy. The patient's parents separated when he was five years old, his mother remarried when he was ten years old, and he always got along well with his stepfather. After graduation from high school, he spent a year in the U. S. Army and then was employed in the Merchant Marine service for twelve years. In recent years, on account of his asthma, he has worked almost not at all. The patient's wife is five years his senior and there is one child aged nine years. Coitus interruptus is practised as a contraceptive measure. He had the usual childhood diseases. Eighteen years ago inguinal hernia was repaired. Fourteen years ago he had an operation for pilonidal cyst, and two years ago he had a tonsillectomy and extraction of all his teeth. All his life he has had some sort of eruption on his skin during very hot weather.

On the Medical Ward he was not very cooperative or truthful. He states he is inclined to be extremely neat, cleanly, orderly and punctual. If things are out of order, he will become emotionally upset and at times an asthmatic attack will be precipitated. He can swim and at present is not frightened of the water. When nine years old he "almost drowned".

CASE NO. 38 M.G.H. #36758 CODE RATING
C D

This fifty-six year old housewife has suffered from asthma since the age of five

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years. Until she was about forty-five years old the attacks were not very severe and occurred only once a year, usually preceded by a cold. About ten years ago she commenced to have hay fever in May and June and then her attacks became more frequent and more severe. However, for the past two years the attacks have again been more frequent in the winter and have also been more severe. She will often start to wheeze when exposed to a cold wind but will clear up immediately upon going into a warm house. Whenever she is nervous or upset for any reason, an attack will be precipitated and she has also noticed that nervousness and worry will aggravate an attack already present. However, she does not recall that her asthma was either worse or better at the time of the nervous breakdown which she suffered when she was thirty-three years old. Her menstruation became irregular about four years ago, her periods stopped entirely nine months ago, and during the past year she has had some hot flashes.

A maternal great-aunt had asthma and a sister has questionable asthma and hay fever. The paternal grandmother, father and two siblings are nervous. The patient was the oldest of five children. When young, she was shy and bashful and in childhood she often had dizzy spells after exertion. She finished grammar school at thirteen years and then worked until her marriage, chiefly as a telephone operator. She was married at twenty-three years and there are four children. Two children are nervous, one has questionable hay fever and another has questionable asthma. The patient has had many vague somatic complaints most of her life. At thirty-three years she had a "nervous breakdown" during which she felt tired and weak, had palpitation of the heart, spent considerable of her time in bed, but was not particularly depressed.

The patient says she does not feel very independent or self-sufficient. She must have everything neat and clean and "an upset house will upset me as much as anything". She is not particularly punctual. She swims but little and is slightly frightened of the water.

CASE NO. 39 M.G.H. #27672 CODE RATING
B D

This twenty-nine year old married truck-driver commenced to have hay fever twelve years ago, but five years ago the hay fever did not return and asthma appeared in its place. Attacks of asthma appear at any time of the year but are worse in cold damp weather. He believes that dust, exhaust from automobiles, and the ingestion of shellfish will cause attacks. If he is nervous or worried about anything while he is having an attack, the attack will become worse but he knows of no conspicuous instances when emotions precipitated attacks. He remembers distinctly that his asthma was fairly severe the day before and the day of his wedding, but he adds that it was raining at the time. Skin tests are positive for timothy, ragweed, redtop, birch and horse hair and slightly positive for cat hair and orris powder. After receiving staphylococcus and ragweed preparations he was free from asthma for one year. He has also been helped by asthma powder, ephedrin and adrenalin.

There is no family history of allergy or nervous disease. The patient was the third of five children. After finishing junior high school at sixteen years of age he went to work as a truck-driver. He was married five years ago, there is one child living and coitus interruptus has been practised. In addition to the usual childhood diseases he had diphtheria in childhood and pneumonia in 1921.

He is inclined to be quite orderly, very cleanly and punctual. He swims but little, is somewhat timid about the water and when he was nineteen years old he "almost drowned".

CASE NO. 40 M.G.H. #36520 CODE RATING
C E G

This twenty-five year old housewife one year ago commenced to have frequent colds, developed symptoms of sinusitis and, in general, did not feel well. She became easily fatigued taking care of her child and doing her housework. At about the same time her father-in-law moved into her house and, since he was not working and was an

economic burden, he was not a welcome addition to the family. Finally the father-in-law found employment, and each week, as soon as he received his wages, he gave the patient money for his board and room. On March 15, 1937, she learned from her husband that the father-in-law had lost his job and she was annoyed at this. The following morning she heard her father-in-law sneak out of the house quite early without leaving any money and this caused her to be very nervous and upset and she had her first asthmatic attack on this day. On the same day her baby was slightly ill with a cold, a doctor was called in but she states that she was not concerned about her child. Since the onset of the asthma, she has had about three attacks each day requiring considerable adrenalin and a few weeks after the onset she entered the hospital. While in the hospital she occasionally "had the blues" when she wanted to see her baby and this would bring on an asthmatic attack. Skin tests are essentially negative. X-ray of the sinuses show thickening of the membranes of all sinuses with polypoid degeneration of one ethmoid.

No family history of allergy; one sister was nervous. The patient was the youngest of three sisters. The mother died when she was three years old, her father never remarried and the patient's childhood was fairly happy. She finished grammar school at fifteen years and for the next ten years she worked about the home. She married four years ago and has one living child. One child died in 1934 of pneumonia and at its death she became quite upset, was very nervous for a few months, developed gastric symptoms, and a diagnosis of peptic ulcer was made. The patient's general health, however, has been fairly good but she had "inflammatory rheumatism" at sixteen years of age.

She has always been nervous, sensitive, worries and frets over small matters, and becomes upset easily. She is very neat, orderly, meticulous and extremely cleanly but is not inclined to be punctual. Since the onset of her asthma, she has had some fear of tuberculosis. Food seems to be an important item in her life because she says she is always talking about something to

eat. She swims well and is not afraid of the water at present but when ten years old she "almost drowned".

CASE NO. 42 M.G.H. #5400 CODE RATING
C E G

This thirty-one year old housewife had her first attack of asthma in January 1934. For several years before this she had been having frequent colds and for two years had been living in a damp house. On December 23, 1933, her favorite brother was killed in an automobile accident and his funeral was held on December 26. She was very much upset over her brother's death and a week after his funeral she had her first asthmatic attack. Since then, attacks have occurred at any time of the year and are quite frequent. If she becomes nervous for any reason, particularly if she becomes annoyed at her children, she will have an attack. Recently she was almost run down by a horse, was greatly frightened, and immediately had a severe attack. Fatigue and cold weather also seem to make her asthma worse. Skin tests are negative. X-ray of sinuses are negative. Vaccines and extraction of infected teeth caused no improvement. Adrenalin is very helpful during an attack.

The mother had asthma, two sisters have asthma and another sister has hives. The paternal grandmother, father, and all her siblings are nervous. Patient was the third of seven siblings. The mother died when she was ten years old and the father never remarried. After finishing the seventh grade of school at thirteen years, she worked about the home for a while and then was employed as a telephone operator until her marriage. She was married at seventeen and there are two children one of whom is nervous and fearful. The patient has always had frequent colds which have been worse during the past five years. She says she has always had "indigestion" and in addition suffers from dizziness when excited and from headaches when tired. For the past five years because of her husband's work, she has been home alone at night a great deal and has had occasional attacks of suffocation, palpitation of the heart and anxiety. After a hot bath her skin will break

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out. As a child the patient had "convulsions".

She has always been rather nervous, is inclined to be very neat and cleanly but is not punctual. When she was six years old she was accidentally locked in a closet, was terror-stricken and, since then, she has had a great fear of closed spaces. Whenever she is locked in a room now she feels suffocated, becomes panic-stricken, and has "hysterics". She has never learned to swim, is very much afraid of the water but remembers no particularly frightening experiences in the water.

CASE NO. 44 M.G.H. #3096 CODE RATING
C E

This twenty-eight year old single secretary had pneumonia at four years of age and has suffered from asthma ever since. At first the attacks occurred about twice each month, were fairly severe and lasted about two days. After the patient was twelve years of age, they became less frequent and tended to be more severe in the fall and winter. After influenza in 1918, she was improved for a while but, in 1928, after an attack of bronchitis, she became worse. Since 1931, she has averaged about one attack a year. Overexertion and hearty laughter have always caused coughing and sneezing. In 1927 her mother died, and her asthma became definitely worse at that time. The attacks became more frequent for a while in 1929 when she was working at a position she did not like. Skin tests are positive for timothy, ragweed, feathers, dog hair, cat hair, horse hair, kapok and house dust. Tonsillectomy in 1927 and vaccines given in 1931 improved her asthma moderately. Also, potassium iodide and ephedrin are of some benefit. X-ray of her nasal sinuses show clouding of the right antrum.

One brother committed suicide and two brothers are quite nervous. One brother has hay fever. The patient was the fourth of five children and was the only girl. Her early life was restricted because of her asthma and she received special attention because of this illness. After graduation from high school at eighteen years she attended business school and since then she

has worked as a clerk and secretary. Sex interest is normal. Except for frequent colds her past health has been good outside of her longstanding asthma.

She does not consider herself nervous but she has little confidence in herself. She is inclined to be quite cleanly and punctual but is not particularly orderly. She swims poorly, fears the water and two years ago she became quite frightened while in the water.

CASE NO. 45 M.G.H. #39026 CODE RATING
A D

This thirty-nine year old single salesman has had asthma since the age of ten years. Attacks are brought on by dust, contact with horses, smoke and cold wind and are usually worse in the winter. When he was twenty years old his asthma improved, and, for the past few years, he has had only two severe attacks each year but he has a little wheezing upon rising every morning. He has worked much of his life as a fisherman, he was always free of attacks while on the sea, but would often have asthma during his first night on shore. Occasionally emotional upsets will aggravate an attack but will never precipitate one. Skin tests are positive for timothy, ragweed, redtop, birch, kapok, flaxseed, horse hair, dog hair, cat hair, chicken feathers, goose feathers, orris powder and house dust. Nothing is known concerning his past treatment.

The maternal grandfather had asthma and a maternal uncle and a cousin had hay fever. His mother and one sister were nervous; the latter had obsessions, refused to eat and apparently died of starvation. The patient was the fourth of six children. He had very little schooling because of illness and because he was not made to go. He has been a fisherman most of his life but for the past two years he has worked as a salesman. He is single and has never shown much interest in the opposite sex. He had typhoid fever in 1935. He occasionally has hives.

As a child he was nervous and easily frightened. He has always stammered. He is quite punctual, cleanly and neat; he must "have everything shipshape". He swims poorly but has no fear of the water. At

twenty-four years of age he "almost drowned".

CASE NO. 46 M.G.H. #44715 CODE RATING
C E H

This forty-seven year old housewife was married at nineteen years and five years later she had to obtain employment outside the home for financial reasons. She often became fatigued because of the job and the necessity of doing her housework in addition. She did not like her position, became nervous over it and when twenty-five years old she had her first asthmatic attack. She was troubled with asthma about once or twice a year until two years ago. The attacks then became quite severe and very frequent, making her an invalid. Attacks often follow colds but they will appear if she overeats, overexerts herself or becomes tired, nervous or upset. Three years before the onset of asthma she became pregnant, considered having an abortion done but finally had a spontaneous miscarriage. Recently she has had guilt feelings concerning this and now believes that her asthma is a punishment from God. Skin tests are negative. She has had tonsillectomy, extraction of infected teeth and several times has had nasal polyps removed. She states that these operations did not help her asthma but her physician does not agree with her on this point. Staphylococcus and streptococcus vaccines and potassium iodide have helped very little but large doses of adrenalin are taken during attacks with moderate improvement.

The maternal grandfather had asthma. There is no nervous disease in the family. The patient was the second of ten children. After finishing two years of high school at sixteen, she worked in a factory until her marriage at nineteen years of age. She has one child aged, sixteen years, and coitus interruptus has been practised. She had the usual childhood diseases, scarlet fever at eight years and a cervical abscess at ten years. For the past four years her menstruation has been irregular and during the past year she has had occasional hot flashes.

She has always been nervous, high-strung, excitable and becomes easily de-

pressed. In childhood she had temper tantrums and bit her fingernails. Before she was so incapacitated with her asthma she was "always on the go". She is not particularly neat or cleanly, but is usually punctual. She cannot swim, is afraid of water and about ten years ago she "almost drowned".

CASE NO. 47 M.G.H. #5380 CODE RATING
B D

This twenty-seven year old housewife early in 1935 commenced to have frequent colds and a few weeks later had her first asthmatic attack. The attacks are more frequent in cold weather, tend to follow a cold and are worse at night. Leaving a warm house and going out into the cold air will cause wheezing. If she is emotionally upset for any reason, particularly if she becomes annoyed at her children, the attack she is having will become worse but she does not believe that her asthma is ever precipitated by emotion. However, she says that she is not likely to have an attack when out of the house, but when she is home and disturbed and annoyed by her children, she is likely to become bothered with her asthma. Skin tests are positive for redtop, horse hair, chicken feathers, kapok, orris powder and house dust. Various vaccines have had questionable results and ephedrin and potassium iodide have not helped. However, the removal of a feather pillow seemed to be of moderate benefit.

A maternal uncle, her mother and one child have asthma and another child has hives. There is no history of nervous disease in the family. Early history is essentially negative. After leaving junior high school at sixteen years, she worked in a shoe factory until her marriage at the age of eighteen years. She says that she knew nothing at all about sex until she was married. There are three children. She is frigid and condoms have been used as a contraceptive measure since May 1936.

Nothing striking was learned about her personality. She is inclined to be fussy, cleanly and punctual, but not particularly so. She cannot swim, is afraid of the water, but has never had any particularly frightening experiences in the water.

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CASE NO. 48 M.G.H. #31105 CODE RATING
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This forty-seven year old married factory worker at the age of twelve years had some difficulty in breathing with severe coughing lasting one day. When he was thirty-five years old he had a similar episode. These continued at rare intervals until four years later when they became worse and more frequent following an abdominal operation. In 1932 he developed a chronic cough and soon afterwards had his first unmistakable attack of asthma. A year later his nasal sinuses were operated upon with complete relief for six weeks but the attacks then returned, became progressively worse, being particularly severe in the winter. If he becomes nervous or angry during an attack, the attack will become more severe. Two years ago he lost all his money, commenced to worry a great deal about finances and when he finally had to receive charity his asthma became definitely worse. Skin tests are slightly positive to kapok, wheat albumin, chicken feathers and house dust. X-ray shows dental infection and clouding of the nasal sinuses. Stramonium asthma powder and adrenalin are of benefit during an attack.

The father had asthma; a sister is nervous. The patient was the oldest of three children. He was born in Italy and came to this country at thirteen years of age. He had very little schooling, went to work at fourteen years and has been employed most of his life in a shoe factory. He was married eleven years ago. An only child died at one year in 1933. Condoms are used at present as a contraceptive measure but a few years ago coitus interruptus was practised and he had some anxiety attacks during that time. He had typhoid fever at nine years. In 1929 he was operated upon for peptic ulcer. He contracted gonorrhea at eighteen years and in 1918 had a chancre. He has received some anti-luetic treatment but his blood Hinton is positive and his spinal fluid shows a weakly positive Wassermann with all other findings negative.

As a child the patient was always restless and "fidgety". He is not neat, orderly, cleanly or punctual. He cannot swim, has

some fear of the water and at nine years was thrown into the water and was quite frightened.

QUESTIONABLE CASES

(Those in which the emotional factors seemed probable but were open to question)

CASE NO. 6 M.G.H. #55890 CODE RATING
A E H

This thirty-two year old white, married factory worker was in an explosion in which eighteen hundred people were killed, including his younger brother. He was thirteen years old at the time and was injured slightly. He was taken to another town about twenty miles inland and about three weeks later had his first asthmatic attack. He knew no other children and was quite lonesome. Wheezing would start immediately upon his leaving the house. About three weeks later he became friendly with some other children and his asthma disappeared entirely. Hay fever started twelve years ago occurring in August and September. For the past two years, he has had asthma during January, February, and March and is most likely to have attacks on a cold damp day or after breathing coal gas or smoke. Skin tests are positive for ragweed, grasses and wheat. He has been improved by an asthma powder, ammonium chloride and by injections of preparations from ragweed and the grasses. Ephedrin has not helped him.

Family history is essentially negative except for one sibling who is nervous and peculiar. Patient is the eldest of six children. As a child he was shy, retiring, and finicky about his food. He finished grammar school at fourteen years of age, did not work for five years, and then went to work in a rubber factory. He was married four years ago and his wife has had two abortions performed. Coitus interruptus is used as a contraceptive measure. He had frequent colds and questionable hives in childhood. For the past few years, he has had occasional attacks of joint pains which he interprets as rheumatism.

Patient is overly neat, but not particularly cleanly or punctual. He is still in-

clined to be fussy about his food. He has never learned to swim but is not afraid of the water. At the age of twenty years he fell from a low bridge into the water, but was able to pull himself out without much trouble and was not frightened at the time. A similar incident occurred six months later.

CASE NO. 13 M.G.H. #7925 CODE RATING
B E

This thirty-three year old housewife developed hay fever and asthma for the first time thirteen years ago. The hay fever is worse in summer, the asthma may occur at any time of the year but tends to be worse when she is out in the cold, when she is in the country or when she is near water. Attacks are most severe at night. On a cold day she will develop asthma when outside, but it will clear up quickly after going into a warm house. She will wheeze if she overexerts herself in the cold and whenever she laughs heartily. She has never noticed that nervousness, worry or excitement affect her asthma. However, she became pregnant about two weeks after her marriage and at the same time her husband lost his job. She was upset emotionally on account of pregnancy and she noticed that her asthma was worse at this time. Skin tests are positive for timothy, ragweed, chicken feathers, horse hair and house dust. Any improvement she might have received from staphylococcus and ragweed injection has been slight.

The mother is nervous, high-strung and easily upset. Several siblings had hives in childhood. A sister has asthma whenever she becomes nervous or upset. Another sister had a "nervous breakdown" six years ago. Patient is the eldest of five children. She had temper tantrums as a child. She attended school until the sixth grade and then went to business school for one year, finishing at seventeen years of age. She then worked as a bookkeeper, waitress and maid until her marriage. She was married six years ago and now has one child aged five years. Coitus condomatus has been used and she is frigid. She had the usual childhood diseases and frequent colds. She had frequent sore throats before

her tonsillectomy at twenty-four years of age. She has been constipated all her life.

She is not particularly orderly, cleanly or punctual. She swims a little, is afraid of water but she can remember no particularly frightening experience in the water.

CASE NO. 15 M.G.H. #11559 CODE RATING
B E H

This forty year old housewife started to have asthma at the age of five years. Attacks occurred about once a month, were not in any way seasonal, but seemed to follow colds. From eleven to eighteen years the attacks occurred less frequently and at eighteen years, when she went to work and felt better generally, her asthma improved even more. However, the attacks became more frequent and more severe about a year after the birth of her son ten years ago. In recent years her asthma has been worse during July, August, September and October and the attacks usually occur at night. If she overeats, particularly of fish, tomatoes, eggs, or any greasy food, or if she is exposed to dust she is likely to have an attack. The onset of her asthma at five years coincided in time with the birth of her brother, who is the next youngest sibling. Also, during the past nine years, when her asthma has been more severe, coitus interruptus has been practised. Skin tests are positive for kapok, cottonseed, chicken feathers and house dust. When she was eleven years old she obtained an atomizer which helped her and she still uses it. She also improved moderately after her mattress and pillows were covered.

A maternal aunt has asthma. Both the father and mother, as well as two siblings, are inclined to be nervous. The patient is the second of six children. Her development was normal and there were no neurotic traits. She graduated from high school at eighteen years, and then did office work for ten years until her marriage. She was married in 1925 and there is one child, a son aged ten years. Coitus interruptus has been practised since the birth of this child. Sexual relations have never been satisfactory. She has been in remarkably good health most of her life.

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quiet, retiring individual, having but few friends. She is inclined to be fussy about her housework, cannot permit herself to leave the house until all the work is finished, and she feels uncomfortable unless "everything is just so". She reads the daily paper and if for some reason she does not have time to read it she must save it until she does; back issues often pile up. She is also cleanly and punctual. She cannot swim, is afraid of water but she does not recall any particularly frightening experience in the water.

CASE NO. 16 M.G.H. #24734 CODE RATING
B E H

This twenty-two year old housewife had her first asthma at the age of ten years. In 1925 her maternal grandmother died, her mother had a "nervous breakdown" and then developed asthma. About a month later the patient had her first attack. She says that her mother's attacks are associated with emotional upsets and with menstruation and whenever the mother has a severe attack she has one also. The patient's asthma is most severe in October and February but she has mild attacks any time during the year. She believes that the presence of dogs and cats will cause attacks and she is suspicious of the rôle played by chocolates, cheese and eggs. She was married in December 1936, and she and her husband lived with her mother. In February 1937, following an argument between the mother and husband, the couple left the mother's home, moved into a furnished apartment and the next morning the patient had the most severe asthmatic attack she has ever had. She believes this attack was caused by the emotional upset, but in this new apartment house there was a cat and a dog. Skin tests are positive for dog hair, ragweed, horse serum, horse hair, chicken feathers, goose feathers, house dust and questionable for milk, kapok and cat hair. Adrenalin has been of definite benefit in attacks but injections of dog and cat hair vaccines have been of only questionable help.

The maternal grandmother was psychotic shortly before her death and had to be taken to a mental hospital where it was reported that she had a brain abscess. The

father was apparently a rather inadequate sort of person, did not support his family and he had separated from his wife two years before his death when the patient was six years old. Patient is the older of two sisters. She said that she weighed thirteen pounds at birth, had two lower teeth and considerable hair and was "born two months late". As a child she was shy, finicky about her food and walked in her sleep. She finished high school at eighteen years and then did clerical work until her marriage. She was married in December 1936. Coitus interruptus has been practised and intercourse occurs only about once a week due to "her poor health". She had the usual childhood diseases and diphtheria. At sixteen she had infantile paralysis and there remains a slight residual in the left arm at present. She had scarlet fever in 1933 and eczema of the nipple of the breast two years ago. Since childhood she has had frequent headaches, not typically migrainous, but these were relieved entirely by eyeglasses obtained six weeks ago.

She has always been nervous and "fidgety". She is very orderly and cleanly and extremely punctual. Food is an important item in her life—"I would rather eat than go to the movies". She swims well, is not afraid of water and has never had any particularly frightening experiences in the water.

CASE NO. 19 M.G.H. #257254 CODE RATING
B E

This fifty-six year old clerk contracted a severe cold in 1930 but despite considerable treatment the cold hung on. In 1931 he had his uvula clipped and was given some vaccine which made his cold worse. In May 1931 he had his first definite asthmatic attack. Two months later he had two operations on his nasal sinuses. The attacks occur at any time of the year and are usually quite severe and in 1932 it was necessary for him to stop working. If he is in "close quarters" such as in an office or at the movies or if several people are visiting in his home, he is very likely to have an attack. Skin tests are essentially negative except for a positive test to house dust. He has been given several different vac-

cines, has had some teeth extracted and has been put on special diets, but his asthma has not been benefited. However, adrenalin always helps in an attack and in addition he improved after an operation on his nasal sinus in 1933.

Family history negative; no history of allergy or nervous disease in the family. Patient is the youngest of six children. The next sibling was six years older and, consequently, he believes that he got more attention. He finished the second year of high school at seventeen years and since then he has been employed at clerical work. He married at thirty years of age and has two children. Past medical history essentially negative except for typhoid fever at twelve years of age.

He has been slightly nervous all his life. The nervousness has been worse since the onset of the asthma. Sudden noises make him "jumpy". He says that the thoughts of other people being well when he is so sick gets him emotionally upset. He has always liked figures and statistics and preferred working at his clerical position even in the evenings and on Sundays, rather than indulging in some recreation. He has always been very orderly and cleanly.

CASE NO. 30 M.G.H. #30332 CODE RATING
B E H

This nineteen year old single stenographer had her first asthmatic attack at the age of three and one-half years, a few months after the birth of her brother who is the next youngest sibling. Attacks occurred irregularly with moderate severity but from seven to fourteen years they appeared less frequently and usually followed colds. From the age of fourteen to seventeen she was entirely free and in 1936 she had hay fever for the first time in August and September. In December 1936 her mother gave birth to a daughter in the hospital and the patient was very worried about her condition. On Christmas night about two weeks later she became hoarse and on the following day had a severe asthmatic attack which she blames on "nerves" and the excitement attending the celebration of Christmas. Her next attack occurred on February 22, a holiday on which

she had planned an outing. Skin tests are positive for ragweed, timothy, goose feathers, horse hair, cotton seed and flaxseed and are questionable for milk, wheat albumin, buckwheat, codfish, horse serum, redtop, orris powder, dog hair and cat hair. Ragweed, staphylococcus and streptococcus vaccines have been of no definite benefit.

The paternal great-grandfather and a maternal aunt had asthma. There is no family history of nervous disease. Patient is the oldest of five children. She has never been very congenial with her brother three years her junior. She graduated from high school at eighteen years and since then has worked as a stenographer. Sex interest seems normal. She had the usual childhood diseases and a tonsillectomy at five years. She has hives after the ingestion of cocoa, cooked cereal and tomatoes. Upon excitement she occasionally becomes nauseated and vomits.

She says she has but few close friends and takes everything in life very seriously. If she starts something, she is not satisfied until it is finished and this often fatigues her. She is very fussy, neat and cleanly and she always wants her clothes and dresser drawers kept "just so". She is always punctual and, in fact, is usually early for appointments. She is frightened of large crowds and watching a big parade will make her feel nervous and excited. She swims well and has no fear of the water.

CASE NO. 49 M.G.H. #12594 CODE RATING
B E H

This fifty-one year old married factory worker became engaged in 1913 and on Christmas Eve, while he was on his way to the home of his fiancée, he had his first asthmatic attack. He does not recall that he was under any particular emotional stress at the time but he does remember that he had been having some nasal obstruction for a few months before this. He had his next attack about a year later and very gradually they appeared more frequently and became more severe. He works in a coffee factory and believes the dust there will cause attacks. He has noticed also that overeating, overexertion and

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being exposed to a cold wind are likely to precipitate attacks. He is least likely to have attacks whenever he is quiet and at rest. Skin tests are essentially negative. Removal of nasal spurs and polyps and a submucous resection of his nasal septum made no change in his asthma and streptococcus vaccines and potassium iodide have been of very little help.

There is no family history of allergy; one sister is nervous and has frequent sick headaches. The patient was the sixth of eight siblings. He was born in Germany and came to this country at the age of twenty-two years. Since finishing grammar school at fourteen years he has worked in factories. He was married at twenty-eight years and has two children. Coitus interruptus is used and for a few weeks three years ago he was impotent.

He says he is a rather easy-going man who lets his wife run the home and he does not permit her nagging to annoy him. He is inclined to be fussy and particular about small matters and is always punctual. When quite young and again at sixteen years he was "almost drowned".

CASE NO. 50 M.G.H. #380121 CODE RATING
B E H

This forty-six year old single telephone operator was unable to obtain steady employment from 1930 to 1934 and she was rather worried about this. Finally she obtained a job with long hours and poor pay, was often fatigued and held a resentment against her employer. In January 1935, following a cold, she had her first asthmatic attack and five months later had to quit working because of her asthma. While on a vacation in Canada she had no attacks but two months after returning to Boston, while she was working in dark, damp quarters, the asthma returned. In January 1936, she developed broncho-pneumonia and was hospitalized. Since then she has not been able to work, has felt tired all the time, particularly in the mornings, and it has been necessary for her to receive charity. She believes that the presence of dogs and of many farm animals is bad for her asthma. In July 1936 her mother died and her asthma became defi-

nately worse, but she says that she was in contact with some animals at the time. Skin tests are very slightly positive to only dog hair and kapok. Potassium iodide, ephedrin and adrenalin give moderate relief.

Maternal grandmother had asthma. The father is described as being a conceited man with a bad temper. The patient's early development was normal and there were no neurotic traits. When she was seven years old the father deserted the mother and it was necessary for the latter to support the family. After finishing the ninth grade of school at fourteen years of age, she worked as a telephone operator for five years. She has also been employed as a manicurist, hairdresser, practical nurse but, in recent years, has again worked as a telephone operator. She has never married but her interest in the opposite sex seems fairly normal. She has had frequent colds all her life, had scarlet fever in childhood, appendectomy at twenty-two years and tonsillectomy at twenty-five years. In March 1936 her menstrual periods began to be irregular and during the past few months she has had some hot flashes.

She has always been sensitive, since 1928 has not been very happy, and has lost much of her usual pep. She has always been very cleanly but not particularly neat nor punctual. She swims well and is not afraid of the water.

NEGATIVE CASES

(Those in which no emotional factors were discovered. These are referred to in the text as the "non-emotional group")

CASE NO. 7 M.G.H. #46986 CODE RATING
A E

This twenty-five year old housewife had her first asthmatic attack five years ago. At the time she was working in a rubber factory and several months before her first attack she was transferred to a department where zinc powder was used. The asthmatic attacks occur about four or five times a year, at any time of the year, and are usually preceded by a cold. She is likely to have wheezing after considerable exertion,

with fatigue and in the cold air. She has noticed that her asthma is somewhat more severe during menstruation and she believes that after she quit work because of a pregnancy, the attacks diminished slightly in frequency. Skin tests have been essentially negative. She obtained no improvement from tonsillectomy but on staphylococcus and streptococcus vaccines she apparently improved moderately. Ephedrin has been of some help during attacks.

Family history is negative; no history of allergy or nervous disease in the family. Patient is the fourth of seven children, early development was normal and there were no neurotic traits in childhood. She started school at nine years, finishing the sixth grade at sixteen years. She went to work in a rubber factory at sixteen years and stopped work at twenty-four years. She was married six years ago at the age of nineteen years, her husband is twenty-nine years old, there is one child, age one year. Coitus interruptus has been used since marriage and patient is partially frigid. Her past health has been very good. She had tonsillectomy four years ago. Since the birth of her baby a year ago, she has been troubled with backaches.

Patient is inclined to be fussy, very neat and cleanly and quite punctual. She does not feel particularly independent or resourceful. She cannot swim and is afraid of water but she has never had any particularly frightening experiences in the water.

CASE NO. 9 M.G.H. #32677 CODE RATING
A E

This thirty-six year old single Greek waiter first developed a cough in 1927 while he was in the Bahama Islands. Two years later he commenced to be "run down", his usual constipation increased, he went on a meatless diet and took special exercises. It was at this time that his asthma had its onset. He awakened each morning with a productive cough followed by an attack. Since he was unable to work because of this illness he went home to Greece for a vacation in 1930, stayed there for twenty-two months. Although his asthma changed but little it seemed slightly improved during the warm weather. The attacks are

more frequent and more severe in the winter and in rainy weather. He has never noticed that he is more likely to have asthma when he is nervous or emotionally upset. In 1934, tonsillectomy was done and in 1936, nasal polyps were removed. Neither of these procedures changed the course of the asthma. Recently it was discovered that he had a purulent nasal discharge and x-rays of the sinuses showed both antra cystic and the membranes of both ethmoids thickened. Skin tests are positive to wheat albumin, chicken feathers and dust. He has obtained moderate relief in attacks from hydriotic acid and ephedrin nasal spray but only questionable improvement from staphylococcus vaccine.

Family history negative; no history of allergy or nervous disease in the family. He was born in Greece, was next to the youngest of eight children, and was the youngest boy. He finished the eighth grade of school in Greece and after coming to this country at fifteen years of age, attended high school in the evenings, graduating at twenty-one years. He has worked most of his life as a waiter and cook. He has never married because he says he is "too particular". He had his first heterosexual experience at twenty-two and he associates with women rather erratically, either going out several times a week, or allowing several months to pass without going out at all. He was impotent on one occasion twelve years ago. Patient's past health has been good. In childhood he had headaches which were not typical of migraine. He has been constipated all his life.

He is very neat, "likes things just so" and everything must be in its place. He becomes annoyed and nervous if things are not orderly and clean. He is not punctual. He worries somewhat about finances and is careful with his money but, on the other hand, he adds that he does not try to get employment very assiduously, tends to excuse himself because of his illness and often thinks that he is lazy. If things do not go well, he is inclined to be somewhat nervous and upset but has never noticed that his asthma is affected by this. He gives one the impression of being a rather mild mannered man, having the childish idea that every-

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thing will turn out well without any effort on his part. He likes to swim and is not frightened of the water. In 1920 while swimming, he had considerable difficulty in reaching the shore because of the current. He became frightened but after that he had no fear of the water.

CASE NO. 10 M.G.H. #6419 CODE RATING
A E

This thirty-one year old single factory worker had his first asthmatic attack about ten years ago. The attacks occur about twice a year and since the onset of hay fever six years ago his asthma has been worse during the hay fever season, that is, during August and September. He has also discovered that he is more likely to have an attack in the morning after he has spent considerable time at his home the evening before. If he stays out late at night, he is usually free of asthma the next morning. Furniture dust, dust from white polish in the shoe factory and overexertion in cold weather cause sneezing and wheezing. He does not believe emotional upsets affect his asthma. Skin tests are positive for ragweed. He has had some questionable improvement from ragweed injections, staphylococcus vaccine and potassium iodide.

Father has bronchitis each winter and is hot-tempered and lazy. Mother died when patient was ten years old. One brother has hay fever. Patient is the second of seven children. Father is a strict disciplinarian, when younger the children were often punished severely and the patient has hardly spoken to his father during the past five years. He finished the ninth grade of school at fourteen years and then went to work in a shoe factory. Patient did not become interested in the opposite sex until he was twenty-four years old. However he has been engaged for the past year and plans to be married soon. Past health has been fairly good. He had an appendectomy at fifteen years, repair of inguinal hernia at sixteen years, and tonsillectomy at twenty-three years.

He says he is independent and self-sufficient. He is inclined to be punctual but is not fussy or particularly neat and cleanly.

He swims very little, is somewhat frightened of the water, and about three years ago he had a mildly frightening experience in the water.

CASE NO. 12 M.G.H. #12166 CODE RATING
A E

This twenty-six year old white married salesman began to have frequent colds at twelve years of age, followed by occasional sneezing and wheezing, usually in cold weather. Four years later he developed definite hay fever and in 1926 his asthma became worse, particularly in the late summer and fall, and he noticed that dust and the presence of dogs and cats would precipitate attacks. In 1931 his asthma had a second exacerbation, and since then the attacks have occurred at any time of the year but have been worse when he was out in the country, particularly after driving on dusty roads. He tells that the muscles of his back tighten up during an attack and that manipulation of his vertebral column by an osteopath will definitely improve him. He also believes that smoking a cigarette helps in an attack and he smokes at no other time. He has also been relieved by ephedrin and asthma powder and believes that staphylococcus and streptococcus vaccines, as well as injections of preparations from the grasses, have helped him a little. He has never noticed any direct relationship between nervousness and his asthma but he volunteered the fact that since his marriage a year ago he has been happier than he has ever been and during this period he has had less asthma. Skin tests are positive for ragweed, orchard grass, cat hair, dog hair, orris powder, silk floss, house dust, chicken feathers and redtop.

Family history essentially negative except for hay fever in a paternal aunt; no history of nervousness in the family. Patient is the older of two brothers, his early development was normal and there were no neurotic traits. While attending school, patient sold papers and worked on a milk route. After graduation from high school at nineteen years, he obtained a job as a furniture salesman. He was married a year ago, his wife is twenty-four years old and there

are no children. The couple lives with the patient's parents. He never had any sexual experiences before his marriage and was often teased about this by his associates. His past health has been fairly good. He had the usual childhood diseases. Tonsillectomy at four years and again at ten years. One month ago he had an inguinal hernia repair. He always has hives after eating strawberries.

He is inclined to be rather overly neat, cleanly and punctual. He states that he was "born scared of the water". When he was a child he used to scream when he was given a bath. He knows how to swim but is still frightened of the water and never dives or goes under the water. At the age of about thirteen years he had a moderately frightening experience in the water.

CASE NO. 14 M.G.H. #19845 CODE RATING
A E

This fifty-one year old white married salesman had his first asthmatic attack on November, 1934. At the time he was shoveling snow, was exerting himself more than was usual for him, and had a sudden onset of dyspnea which was relieved in a few minutes after a doctor gave a hypodermic injection. He had no more trouble until January 1936 when he had a similar attack upon awakening in the morning. A doctor was called and diagnosis of asthma was made and again a hypodermic injection gave complete relief in a few minutes. The patient was free from symptoms for a year until January 1937 when he had another attack, following a lunch of milk, cheese and hard-boiled eggs which caused him to vomit. Since that time he has had considerable wheezing upon exertion. In the middle of January 1937, the patient's asthma kept him from work. He was discharged from his job and since then has had severe attacks almost every night. He considers his employer "cheap" for discharging him and because of his poor economic condition it has been necessary for him to receive financial aid from his son and brother and this hurts his pride. Skin tests positive for timothy, ragweed, redtop, house dust and suspicious for milk, flax seed and orris powder; it has been pointed out that

these positive tests do not fit in with the story. Adrenalin gives prompt relief during an attack but staphylococcus vaccine has not helped him. Diagnostic studies have ruled out heart disease.

Family history essentially negative; no history of allergy or nervous disease in the family. Patient was the younger of two brothers, early development was normal and there were no neurotic traits. After finishing the second year of high school at seventeen years, he went to work as a salesman. He married at thirty years, his wife died in child birth six years later. His son, age twenty-one years, was reared by his maternal aunt and until recently the patient lived with them. In childhood he had the usual childhood diseases. He had pneumonia and empyemia at fourteen years and appendectomy at twenty-nine years.

He describes himself as being an easy-going, peaceful man, but adds that he has always been somewhat "fidgety" and nervous. He is inclined to be overly cleanly, orderly and punctual. He cannot swim but is not particularly frightened of the water.

CASE NO. 21 M.G.H. #53624 CODE RATING
A E

This forty-six year old white single housemaid had her first asthmatic attack in the summer of 1916 and continued to have frequent attacks until the following spring. She had no more difficulty until 1922 when her asthma returned and again cleared up in the spring. For the next six years she had only slight wheezing with colds but in 1928 she had hay fever in the summer and her asthma reappeared at this time. She again had exacerbations in 1931 and 1933 and in 1934 it was necessary for her to be hospitalized on account of the severity of the asthma. In the summer of 1937, she was again hospitalized. Skin tests done on several occasions have all been negative but the patient believes that proximity to flowers as well as cold air will precipitate attacks. Vaccines seemed definitely to help at first but soon lost their efficacy. Adrenalin is of definite benefit during an attack. Removal of nasal polyps and of infected teeth produced questionable results. She has never noticed that emotional

upsets will precipitate or aggravate attacks and she definitely remembers that she did not have asthma at her mother's death in 1927. While she was in the hospital the nurses considered her to be "neurotic and hysterical". During a particularly severe attack while in the hospital she became quite upset emotionally, was afraid that she was going to choke to death, was quite noisy and laughed and cried alternately. She told of having a similar kind of upset during an attack in 1926.

Paternal grandfather and mother both had bronchitis, and a brother has hay fever and questionable asthma. Patient was born in Ireland and was the second of nine children. As a child she was quiet and bashful, bit her fingernails, was finicky about her food and had nightmares. She finished grammar school at fourteen years and from fourteen to twenty-two years she worked on her father's farm in Ireland. Then she came to this country and here she has been employed steadily at housework. She has apparently had normal interest in the opposite sex but for some reason, unknown to her, she has never married. Except for asthma the patient's past health has been very good. She had the usual childhood diseases, influenza in 1918 and nasal polyps removed in 1921.

Patient says she feels independent and self-sufficient and is well able to take care of herself. She states she is fussy, orderly and very cleanly and punctual. Before the onset of her asthma she swam occasionally and is not afraid of the water. In 1917 while swimming her legs were caught in the seaweed, she was greatly frightened and "almost drowned".

CASE NO. 24 M.G.H. #47520 CODE RATING
A E

This fifty year old Russian-born Jewish widow commenced to have hay fever and asthma seventeen years ago. The hay fever comes on in the middle of August, disappears at the first frost and she has asthma during this time and for a short time afterwards. She says that going out into the country during August and September is "like going into a beehive". Whenever she laughs heartily or walks fast she will com-

mence to wheeze and after taking coffee or aspirin she will "choke up". She has never noticed any relationship between her asthma and emotional upsets. Skin tests are positive for timothy, ragweed, reed top and orchard grass. Injections of preparations from these grasses have helped both the asthma and the hay fever and whenever they are omitted she is definitely worse.

Father died when the patient was two months old; mother died when she was seven years old. One sister is nervous; no family history of allergy. She was the youngest of six children. From the age of eleven to eighteen years she worked as a milliner, then she came to this country and was married the same year. Her husband was killed in an automobile accident eight years ago. She has three children and the youngest son, aged twenty-six years, is nervous and vomits whenever he gets excited. She had the usual childhood diseases and has had some sort of trouble with her urinary bladder off and on for the past thirty years. For the last three years she has had "gallstones and rheumatism" and two years ago a tonsillectomy was done.

She is very fussy and cleanly and if anything is not done in the right way and not done thoroughly she becomes nervous. She is also very punctual. She swims very little but is not frightened of the water.

CASE NO. 26 M.G.H. #6372 CODE RATING
A E

This seventeen year old youth has had asthma since the age of thirteen months. The attacks usually come on in the winter-time, are associated with colds and may be precipitated by overexertion. His family has moved around a great deal with no definite change in his asthma. In 1932 he was hospitalized because of osteomyelitis and he had no attacks during a four months period. From 1932 to 1935 he attended a hospital school for chronic invalids and while there had about two mild attacks each year. Since July 1935, he has been living at home and the attacks have occurred about every three weeks. Skin tests are positive for ragweed, cat hair, dog hair, horse hair, orris powder and house dust. He remembers definitely one experience when

he had an attack after an exposure to a dog. Vaccines have not helped him but the removal of feathers from his bedding seemed to give moderate benefit.

Father has asthma, is quite nervous and irritable and in 1925 had a "nervous breakdown". The mother is nervous and irritable and had asthma as a girl. A paternal aunt, a maternal aunt and a younger brother all have asthma. A paternal cousin has hay fever. Early development was normal. When young, the patient was quite fearful and was finicky about his food. Because of illness, the patient missed a great deal of school but finished grammar school at the usual age. In recent years he has attended a vocational school but had to give this up on account of his asthma. A few months ago he commenced to work as a stock boy in a department store. He had the usual childhood diseases and believes he had eczema as an infant. Tonsillectomy at six years. His osteomyelitis was operated upon at twelve years.

He impresses one as being an entirely normal boy. He says he is careless, rather neat and not inclined to be particularly cleanly or punctual. He knows how to swim but is not frightened of the water.

CASE NO. 31 M.G.H. #46746 CODE RATING
A E

This thirty-eight year old, white, married factory worker had his first attack of asthma in 1923 while he was working in a ship-yard. He developed hay fever in 1920 and in 1921 a diagnosis of vasomotor rhinitis was made. His asthma begins in May of each year, continues until about August first, and he never has any trouble at other times of the year. During attacks, he requires considerable adrenalin for relief. Smoking will cause wheezing and he has noticed that asbestos dust, with which he comes in contact in his pipe-fitting work, will cause nasal obstruction. He had an operation on his nose in 1921, this did not help his asthma but he has had no hay fever since. In 1931 a diagnosis of pansinusitis was made by x-ray. Skin tests are all negative except for slight reactions to timothy, ragweed, redtop and birch.

One aunt has asthma and a sister has

hay fever. Two brothers died of tuberculosis. One brother has had "nervous indigestion" since he was shell-shocked in the War. Patient was the youngest of eleven children. Early development was normal. He finished grammar school at fourteen years and then went to work in various factories and for the past five years has been a stationary fireman. He was married three years ago after a courtship of five years. The first child was still-born and the second premature and died a few days later. Because of his poor economic situation he does not want any children now and "rhythm" has been used as a birth control measure. He had the usual childhood diseases and at twelve years of age, had double pneumonia. In 1921, he had three operations on his nose and a tonsillectomy. Nasal polyps were removed six years ago and he had acute rheumatic fever five years ago. From 1928 to 1931 he had hives frequently and says that beer, tomatoes, strawberries and highly seasoned foods will cause itching of his skin.

He says that he is not a very talkative person, does not mix well and does not make friends very easily. He is not particularly orderly, cleanly or punctual. Patient can swim and is not afraid of the water. At about seven years of age he fell off a wharf, "was going down for the third time and somebody grabbed him and pulled him out".

CASE NO. 33 M.G.H. #3394 CODE RATING
A E

This twenty-three year old white single clerk had his first asthmatic attack in August 1936. Three months before this the family had moved and, on that night, he slept in a different bedroom, the walls of which had been sprayed for moths. He developed a cough and during the night had his first attack. Since then he has noticed that he is more likely to have an attack after spending considerable time in the home. For instance, he believes that he is more likely to have an attack upon arising in the morning whenever he retires early the night before. Also, he thinks that he has asthma most frequently on Monday mornings and believes this is due to the

fact that he spends so much of his time at home on Sundays. Wheezing will occur whenever he goes into the refrigerator in the meat market where he works. Skin tests are positive for ragweed, kapok, beans, cat hair, horse hair, chicken feathers and house dust. A scratch test for the moth spray used in his home was negative. Staphylococcus and streptococcus vaccines have apparently been of some benefit.

No family history of allergy or nervous disease. Early development was normal and there were no neurotic traits in childhood. He finished high school at eighteen years of age and since then has worked as a gardener, and a cashier. For the past two years, he has been employed as a clerk in a meat market. Past health has been fairly good. He had the usual childhood diseases, as well as pneumonia one year and eczema in infancy. Tonsillectomy was done at six years and again at nine years.

Nothing abnormal was learned concerning the patient's personality. He is not extremely cleanly or punctual. He swims well and is not afraid of the water. At the age of six years he was pulled out of the water but at the time was not frightened in the least.

CASE NO. 35 M.G.H. #8024 CODE RATING
A E

This twenty-nine year old, white, married laborer was struck on the nose while playing baseball at fourteen years of age and after this had some difficulty breathing through his nose. The following fall he developed asthma and since then the attacks have occurred all the year round, but have been worse in damp weather. He is quite likely to have an attack on Monday or on the day following a holiday. He explains this by saying that he "runs around and keeps late hours". During an attack he is inclined to be rather irritable, but says emotional upsets have never precipitated or aggravated the attacks. Skin tests are strongly positive to ragweed and slightly positive to orchard grass, timothy, sheep's wool, beef, onions, dog hair and cat hair. Examination shows narrowing of the nasal air passages. Adrenalin is effective in an attack, potassium iodide also seems to

be of definite benefit but the effect of staphylococcus vaccine is questionable.

The mother has hay fever, is nervous and worrisome. A sister has hay fever and asthma and another sister has epilepsy. Five siblings died in infancy. A maternal aunt has hay fever. The patient is the youngest child and only boy. He finished the first year of high school at fourteen years and left school because of his asthma. He has worked at various jobs and lost many positions on account of his illness. He was married five years ago. His wife is nervous and irritable. There are three children. For the past eighteen months coitus interruptus has been practised. He had eczema as a child, influenza in 1918 and an operation on his nose at the age of sixteen years.

The patient impresses one as being an entirely normal person. He is not overly cleanly or orderly but is usually punctual. He knows how to swim and has no fear of the water.

CASE NO. 41 M.G.H. #2123 CODE RATING
A E

This twenty-three year old housewife had broncho-pneumonia in 1930, after this had frequent colds, and in the fall of 1932 had her first asthmatic attack. Since then she has had frequent severe attacks every fall and winter but has been free the remainder of the year. The attacks occur particularly after colds and exposure to dust. The onset of the asthma and the use of coitus interruptus coincide in time but, as mentioned before, her asthma is definitely seasonal. Skin tests are positive for egg white, kapok, milk and dust. X-rays of the sinuses show slight thickening of the membranes of the antra. Adrenalin gives relief in attacks, but vaccines, belladonna and potassium iodide do not help.

Maternal grandfather and a paternal great-aunt had asthma. Mother apparently had some endocrine dysfunction, since she is extremely obese and her menses ceased at twenty-eight years of age. Patient has only one sibling, a younger brother. She finished the ninth grade of school at fifteen years of age and was married that year. There is one child, age seven years; for two

years after its birth coitus condomatus was practised and for the past five years coitus interruptus has been used. She had a cholecystectomy in 1930. Menses have never been very regular and for the past eighteen months she has menstruated only every seven or eight weeks and the amount of flow has been diminished.

During the past few years the patient has been nervous and irritable at times. When she is well she tries to keep her house looking neat and clean. She is a good swimmer and has no fear of the water.

CASE NO. 43 M.G.H. #10424 CODE RATING
A E

This twenty-nine year old, white, single, unemployed man had his first asthmatic attack at the age of fifteen years and believes it was brought on by breathing sulphur fumes. For the next three years he had only about five attacks a year but then he became worse and went to a hospital for study. The attacks come on at any time of the year, usually at night and they have been less severe for the past two years. For several years he has had frequent attacks of sneezing which occur at any time of the year and usually last only one day. Skin tests are positive for horse dander, timothy, chicken feathers, ragweed, dog hair, house dust, wheat, milk, egg white, orris powder

and cotton. He has been given staphylococcus and streptococcus vaccines with questionable results.

Father and two sisters have bronchitis. Mother is nervous and worrisome, has asthma and also suffers from sick headaches with vomiting. One sister is inclined to be nervous. As a child patient was rather nervous and finicky. He remembers when he was nine years old that an older boy put him into a doghouse against his will and frightened him a great deal and ever since, he has been afraid of dogs. He finished high school at the usual age and then went to business school and has worked some in clerical positions. He became interested in the opposite sex at the usual age but has shown less than the usual interest towards women. Except for his asthma he has been in fairly good health. He had scarlet fever at five years and pneumonia at seventeen years.

He has not worked for the past four years and seems to have very little drive. He has been perfectly satisfied to spend his time playing cards, bowling and golfing and has put out no effort to find employment. One gets the impression that he is quite attached to his parents. He is not particularly orderly or cleanly but is usually punctual. He cannot swim but is not afraid of the water.

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THE CORRELATIONS BETWEEN OVARIAN ACTIVITY AND PSYCHODYNAMIC PROCESSES: I. THE OVULATIVE PHASE*

THERESE BENEDEK, M.D., and BORIS B. RUBENSTEIN, M.D., Ph.D.**

THE EXISTENCE OF RELATIONS between gonadal function and emotional states had been inferred before the dawn of history and can be traced in the folklore of nearly all people. The emotional changes associated with puberty and menopause in both sexes are well known.

The ebb and flow of emotion in the adult woman has also been associated in a vague way with the cycle of sex function. Premenstrual nervousness, apathy and depression have often been described in the clinical literature. Less well known, but recognized, are the sudden changes of mood associated with "Mittelschmerz" and other mid-period symptoms, which have recently been related to ovulation. For a review of pertinent literature see Seward (22). Proof of such correlations has, however, been strikingly absent due to ignorance concerning the precise details of the cycle in women on both the physiological and psychological sides. The recently described day-by-day

study of vaginal smears and basal body temperatures (19, 20, 21) offers an approach to the problem on the physiological side. The psychoanalytic method offers a powerful tool for investigation on the psychological side.

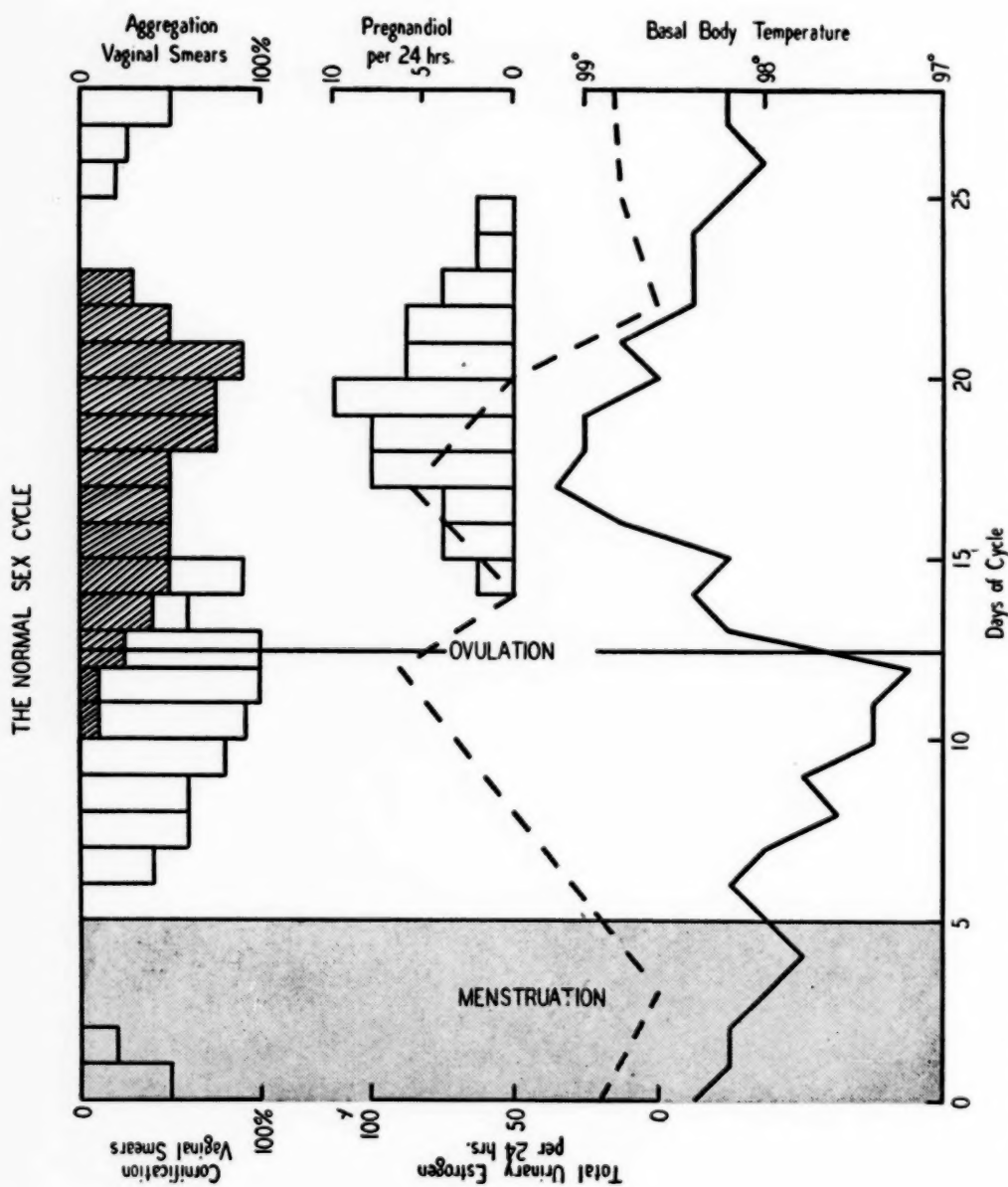
The cycle of sex function in the adult woman centers about ovulation. The process of ovulation is merely the rupture of a mature follicle and expulsion of its ovum. It implies preliminary phases of follicular maturation, and subsequent phases of corpus luteum formation. During this entire period, the ovary is the source not only of the ovum but also of hormones which exhibit their characteristics throughout the body, preparing it for pregnancy. If the mature ovum is not fertilized, pregnancy does not occur. The uterine mucosa which hormonal stimulation had prepared for nidation of an ovum breaks down upon cessation of the hormonal stimulus and menstruation occurs. It is usual to think of the cycle from one menstrual period to the next. The present description will follow this scheme.

Usually, by the end of menstrual flow, the ovary shows first evidence of follicle development. Follicle maturation usually continues for about ten days during which time there is an increasing production of oestrone (the follicular or female sex hormone) which stimulates uterine proliferation. At about the time of maturity, but before rupture of the follicle, lutein cells appear in its lining (granulosa) and begin production of progesterone which stimulates the secretory activity of the

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GRAPH 1. The normal sex cycle: the solid curve represents the basal body temperatures; the broken curve presents the excretion of oestrogenic substances (female sex hormone); the clear blocks of the center are the excretion of pregnandiol sodium glucuronide (metabolite of progesterone, the corpus luteum hormone); the uppermost set of blocks presents the vaginal smears,—the clear blocks indicating cornification, the shaded blocks aggregation. The broken curve is a composite from the data of Gustavson et al., Pedersen-Bjergaard, and Palmer. The pregnandiol excretion is after the data of Venning

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uterus. Normally, follicular rupture, ovulation, occurs a few hours later, but is occasionally delayed for some days. After ovulation the former follicle space is invaded by more lutein cells from its lining (theca luteinization) and these produce both progesterone and an oestrogen (estriol?), which maintain the uterus in a state suitable for reception of the fertilized ovum. Upon atresia of the corpus luteum, progesterone production diminished, the uterine mucosa breaks down, and menstruation follows.

The existence of a hormonal cycle which is reflected in the vaginal smears and basal body temperature has been established. It was, therefore, interesting to see whether the psychological material could be correlated with the hormonal

purpose. They were instructed to make their vaginal smears and take rectal temperatures daily. The smears and temperatures were sent to Dr. Boris B. Rubenstein of Western Reserve University, Cleveland, Ohio, for study. The psychoanalytic records were studied by Dr. Therese Benedek at Chicago. After ten months had elapsed the two investigators met to compare for the first time the data of their independent investigations. Both sets of records had been summarized in tabular calendar form. The calendars were superimposed. We were pleased and surprised to find an exact correspondence of the ovulative dates as independently determined by the two methods. The following table represents such a procedure.

TABLE I

Case I. G. S.	Prediction on the basis of Psychoanalytic material	Physiological findings
Cycle IV Aug. 28-Sept. 23 26 days	Sept. 2: Heterosexual tension starts Sept. 4: Preovulative tension Sept. 7: Preovulative Sept. 8: Postovulative material Sept. 14: First premenstrual evidence Sept. 23: Menstrual flow	Sept. 2: Smear full of masculine secretion Sept. 3: Very beginning of cornification Sept. 4: Increasing cornification Sept. 8: Ovulation Sept. 14: First premenstrual evidence Sept. 23: Menstrual flow
Cycle V Sept. 23-Oct. 19 28 days	Oct. 1: Preovulative tension Oct. 3-4: Ovulation(?) Oct. 4-5: Ovulation(?) Oct. 9: First premenstrual evidence Oct. 18: Increased premenstrual tension Oct. 20: Menstrual flow	Ovulation could occur from Sept. 28-Oct. 7. There is evidence that it occurred before the 6th; assume October 3rd. Oct. 10: First premenstrual evidence Oct. 18: Cornification Oct. 20: Menstrual flow
Cycle VI Oct. 20-Nov. 14 25 days	Oct. 23: Heterosexual tension Oct. 27: Preovulative Oct. 31-Nov. 1: Ovulation Nov. 5: First premenstrual evidence Nov. 14: Menstrual flow	Oct. 24: Minimal cornification Oct. 27: Increasing cornification Oct. 31: Complete cornification Ovulative Nov. 1: Postovulative Nov. 5: First premenstrual evidence Nov. 14: Menstrual flow

cycle. Our first question was whether the phases of the ovarian function are reflected in the psychic processes as observed during the psychoanalytic procedure. Patients who were under treatment for various neurotic disturbances at the Institute for Psychoanalysis of Chicago were selected for this

It might be assumed that the psychological structure of the patient whose records we first studied facilitated the location of the ovulative dates. We made the same comparative study of three other cases with various symptoms and different psychodynamic structures, with the same results. In

vaginal smears,—the clear blocks indicating cornification, the shaded blocks aggregation. The broken curve is a composite from the data of Gustavson et al., Pedersen-Bjergaard, and Palmer. The premenstrual excretion is after the data of Venning

those cycles in which hormonal and psychoanalytical material were available for the ovulative period, the date of ovulation was predicted. We missed complete coincidence only in those cycles in which either the patient failed to take the smears or when there were no psychoanalytic sessions.

After our first encouraging results our task was to find those characteristics of the psychoanalytical material

which enabled us to distinguish the various phases of the cycle.

We therefore reviewed the same material day by day. We studied one case during ten cycles, a second case during eight cycles and the third and fourth cases during five cycles each and found that the psychoanalytic material in the normal cycle shows typical changes which are described briefly in the following paragraphs.

TABLE II
CASE R. E.*

Date	Psychoanalytic Material	Prediction	Physiological Findings
Oct. 19-24			Menstrual flow; no smears
Oct. 25	Cheerful; no dream		No smear
Oct. 26	Heterosexual dream content and associations	Starting oestrone tension	Beginning cornification. Extreme leukocytic invasion. Definitely preovulative
Oct. 27	Heterosexual desire and feminine exhibitionistic tendencies	Increasing oestrone tension	
Oct. 28	Cheerful. Dream material: admiration of brother—associations: fear of brother and of incest	Increasing oestrone tension	Increasing cornification
Oct. 29	Castration wishes—heterosexual material—impregnation wish—lutein; Mittelschmerz	Preovulative tension	Lowest point of temperature curve. Minimal folding of completely cornified smear—late preovulative
Oct. 30	No analytic material		Cornification 75% (slight regression)
Oct. 31	Dream: Strongly heterosexual—fear of impregnation	Preovulative	Cornification 90%. Minimal folding
Nov. 1	Dream: Heterosexual material. 1° Masochistic and identification with brother. 2° identification with mother. Impregnation material	Preovulative	Cornification 100%. Slightly more folding and aggregation
Nov. 2	Dream: Heterosexual wishes and fear of being attacked. During hour fear of pregnancy, increased fear and suffocation	Ovulative	Cornification 100% with more luteal activity—Ovulative
Nov. 3	Cheerful, rushing: Analytic association superficial hypomanic	Post-ovulative	Leuk influx—clearly post-ovulative
Nov. 4	No dream; excited, happy, eager, animated. Associations are resistive	Post-ovulative	Definitely post-ovulative
Nov. 5	No dream. Feels full and bloated. Associations deal with fear of identification with mother. Fear of pregnancy	Lutein phase	Definitely post-ovulative
Nov. 6	No analytic hour		Clear lutein state

* The ovulative phase of this cycle, Oct. 30-Nov. 4 is presented in detail in the text of this paper, pp. 259-261.

CASE R. E.—*Continued*

Date	Psychoanalytic Material	Prediction	Physiological Findings
Nov. 7	No analytic hour		Occasional cornified cell. First premenstrual evidence
Nov. 8	Dream: heterosexual wish and aggression toward brother	Premenstrual	Premenstrual; low oestrone level
Nov. 9	Fear. Great need for protection. Great dependency		Premenstrual with low oestrone
Nov. 10	Craving for sweets. Dream shows castration wish toward a boy. Boy's bleeding—menstruation—castration	Premenstrual	Premenstrual
Nov. 11	Fear of identification with mother on sexual level; fear of insanity	Premenstrual with increased oestrone and minimal progesterone	Late premenstrual
Nov. 12	Tension increases. Pain in stomach. Fear of sexual attack. Relaxed during analytic hour	Increased premenstrual oestrone	Increased oestrone output. Premenstrual
Nov. 13	Aggravation of symptoms, especially fear, diarrhoea. Analytic material: Fear of sexual attack	Increased premenstrual oestrone material	No smear
Nov. 14	Heterosexual material	No relaxation of oestrone tension	Menstrual flow starts. Cornification 90%

During the follicle ripening phase the psychological material is dominated by heterosexual interest. The libidinous tendencies are concentrated on the male. The heterosexual desire becomes increasingly strong during the ripening phase. With normal sexual adjustment the increasingly strong heterosexual desire finds normal gratification. Without sexual gratification, the heterosexual tension can be dammed up so that increasing hormone production causes an increased tension.

In neurotic persons we observe that this increasing oestrone production activates the psychological conflicts and thus the neurotic symptoms are intensified. The great psychic tension is suddenly relieved (but only for a short time) when ovulation occurs. The libidinous interest is withdrawn from the outer world and centered on her self. She is self-satisfied, wants to be loved and to be taken care of. She is content to be a woman. The period of post-ovulative relaxation is necessarily

of short duration. Hormone production increases rapidly after ovulation. Although both hormones are produced during the luteal phase progesterone now dominates the hormone picture. The psychological material corresponding to this phase of the cycle shows the tendency to be passive and receptive. The tendency to be impregnated, the tendency to be pregnant, the tendency to care for a child and the various reactions to all these are reflected in the psychological material. After this phase of the cycle reaches its peak the corpus luteum starts to regress and with it the production of progesterone diminishes. After regression of the corpus luteum many new follicles begin their development. Ordinarily none of these follicles is destined to mature. However, they do produce oestrone in small quantities. This is immediately reflected in the psychological material by the reappearance of heterosexual interest.

The heterosexual desire of the premenstrual phase is similar to that of

the pre-ovulative phase. In the late premenstrual state this heterosexual tension is complicated by the expectation of menstruation. This expectation of the menstruation is in turn reflected in the psychological material.

Normally the follicles regress by the end of the cycle. Occasionally one of the immature follicles may be luteinized and therefore will complicate the hormone picture by producing minimal amounts of progesterone. This will also complicate the psychological material.

It should be noted that Dr. Thomas M. French studied one case in which the vaginal smears were taken by the same technique and established the various phases of the cycle on the basis of the psychological material. This case is not included in the present paper.

As an example of our day to day study and the correspondences it demonstrated, we have presented Table II, one cycle of patient R. E.

On the basis of our preliminary study we set ourselves the following hypotheses:

- 1) Increasing heterosexual tendency is correlated with increasing estrone production.
- 2) Relaxation and contentment are correlated with ovulation.
- 3) The passive and receptive tendencies, the tendencies toward pregnancy and toward nursing are correlated with progesterone production.
- 4) The reappearance of heterosexual tendencies marks the onset of the premenstrual phase which results from new oestrone production.

Further studies were carried out in the light of these hypotheses. This report is based on our study of seventy-five cycles of which twenty-three were ovulatory. It is of interest to note the frequency of anovulatory cycles in our neurotic patients although the patients were of child-bearing age. Even in the anovulatory cycles there was sufficient

fluctuation of hormone production to define the characteristics of the cycle. The psychological material reflected these daily changes and naturally failed to show the psychological relaxation characteristic of ovulations.

METHOD

1. *Physiological:* For our evaluation of gonad function, we employed the vaginal smear-basal body temperature technique recently described by one of us (19, 20, 21) with certain modifications. Since the patients were in Chicago and the laboratory work was done in Cleveland, slides of the vaginal smears had to be shipped and, therefore, dried. To compensate for loss in cytological detail consequent on drying, we advised the patients to take the smears with a stiff wire loop inserted into the posterior fornix of the vagina; we thus obtained comparable smears from day to day. The smears were stained according to the method of Papanicolaou (16) and evaluated without reference to either the temperature or the psychological data. In general, they were adequate for a decision concerning the phases of the cycle represented. It should be noted that since much of the material was pathological, we followed a scheme for evaluation of slides as follows.

Slides were examined and a rough quantitative estimate made of the proportions of various squamous epithelial cell types as follows:

- 1) Normal cells with vesicular nuclei.
- 2) Cells with granular cytoplasm and pyknotic nuclei.
- 3) Cells with keratinized cytoplasm and pyknotic nuclei.
- 4) Cells with keratinized cytoplasm and fragmented nuclei.
- 5) Cells with "moth-eaten" edges, folded over.

6) Cells folded and aggregated into masses.

The presence of marked desquamation of epithelial cells in the absence of sperm and red blood cells was given careful consideration. The presence or absence of leukocytes, red blood cells, thick tenacious mucous and of spermatozoa was noted.

Since, under the influence of oestrone, whether produced by the maturing follicle or injected, all mucous membranes (14) and in particular the vaginal mucous membrane proliferates (4, 13), the superficial cells grow away from their blood supply and begin to undergo the degenerative processes called cornification (types 2 to 3 to 4). We assume, therefore, that in an untreated woman the progressive change in smears from type 1 through to type 4 is indicative of a progressively maturing follicle. Luteal cells appear in the granulosa of the follicle just before ovulation and frequently even when the follicle is doomed to atresia (6, 15, 16, 17).*

Minimal evidence of progesterone activity associated with a high oestrone level is therefore the criterion of the ovulative phase: in the vaginal smear it is recognized by either increased desquamation of type 4 cells or by the appearance of type 5 and 6 cells together with type 4. In the post-ovulative phase the increasing level of progesterone neutralizes the effect of oestrone on the mucosa (13, 24). There is progressive desquamation and degeneration of the proliferated, cornified epithelium and therefore the preponderance in vaginal smears of type 5 and 6 cells, together with the appearance of occasional cells from deeper layers, *i.e.* non-squamous epithelium. Upon atresia of the corpus luteum, new follicles develop under stimulation by the uninhibited anterior pituitary, even before menstruation. Therefore, there is usually a recurrence

of oestrone activity—of cornification in the vagina in the premenstrual-menstrual phase. The smear evidence indicates that menstruation occurs despite the presence of a low or even moderate oestrone concentration.

The temperature data are interpreted independently. Recent studies (20, 21) confirmed by Zuck (26) demonstrate the existence of a temperature curve in the normal, adult woman. There is a rise of temperature in the mid-month period correlated with ovulation as determined by smears (19), electrical disturbance (5, 18), and by pregnancy due to single coitus (26). The temperature rises after ovulation to its zenith, about one week premenstrually, and is related to maximum corpus luteum function. The temperature then falls gradually during the next two to three weeks presumably under the influence of the gradually increasing oestrone level (20, 21, 23) which inhibit the pituitary progressively until several hours before ovulation when the temperature reaches its nadir (*i.e.* maximum oestrone, no progesterone production). As soon as leuteinization of the mature follicle begins, the temperature again starts to rise signalling impending ovulation. The patients selected for this research were given instructions by a woman physician as to how to take the vaginal smears and the rectal temperatures. They received also the necessary material and other instructions regarding the handling of the slides from a laboratory technician, to whom they gave the smears and temperatures every two or four weeks. This whole technical procedure was managed so that the analyst working with the case was not involved.

Psychological: One of the cases was

* Since preparing this paper two more publications have appeared which demonstrate that initial leuteinization occurs just before ovulation.

studied for the period of 15 menstrual cycles, 2 cases for 12 cycles, one for 11 cycles and the others for a period of 4 to 6 cycles. Seventy-five cycles of 9 patients were studied; which means about 2000 day-by-day diagnoses of their psychodynamics.¹ Besides this, the author (T.B.) studied and made similar diagnostic interpretations of the same cases during those periods of their psychoanalytic treatment when vaginal smear tests were not made. Of these nine cases, two were analyzed by the author (T.B.); seven by other psychoanalysts in connection with the Chicago Institute for Psychoanalysis.

These investigations based on psychodynamic changes occurring every day and related to the day, would not have been possible except on the basis of daily recorded material.

We do not have mechanical records and therefore no verbatim record of any analytical session. In spite of this, a "good record" conveys the content of the psychoanalytical session to another psychoanalyst. It contains the patient's recent important experiences, the emotional state, and the various topics of the session in the sequence of the associations. Even when the record is not verbatim it should cite the patient's own expressions. The patient's verbalisation reflects her feelings and enables the person studying the record to get in touch with the recorded emotional state. The most important parts of the records are the dreams. The dream is the most sensitive instrument for the registration of psychic changes. In these investigations the dreams were used as the "objective" material of the psychoanalysis² (7, 8, 9). It is neces-

sary, as far as possible, to record the dreams in the patient's own words and the flow of the associations. If the record does not contain the course of the analytical session at least partially expressed in the patient's own words, it offers a great source of error in interpretation. Records which contain mainly the summaries of the hour in psychoanalytic terminology permit only a review of the interpretations of the analyst. No matter how correct the interpretation may have been, psychoanalytic interpretation by another investigator is possible only with great tolerance for error.

Of course it is impossible to go into detail about the technique of interpretation of the recorded psychoanalytic material. Every kind of psychological material available was utilized. We had to evaluate the conscious emotional and physical condition of the patient, her actions and experiences. The symptoms of the patient belong partly to conscious material, and partly to unconscious material. Psychogenic symptoms are results of conflicting psychodynamic tendencies and can be analyzed in relation to the hormonal state. The most important materials for this investigation were the dreams, associations, and the transference.³ The interpretation of all this material differs from the usual interpretation technique of any experienced analyst in but one respect—all the recent determinations

paper "Reality and the Unconscious", he explains: "I am using the chronological order of appearance of the manifest dream elements in order to trace the shifts of emphasis that bring into focus one after another during the act of dreaming different parts of the latent dream thoughts. These shifts of emphasis I regard as quantitative indicators of the balance between conflicting tendencies just as conscious thoughts and actions during waking life are indicators of the quantitative balance between the motives that activate them".

³ Transference is the repetition of emotional experiences, which during the analytic procedure becomes manifest in relation to the analyst or to the analytic situation.

¹ A comparative evaluation of the daily findings by both methods—which offered practically complete correspondence—will be published later.

² Thomas M. French in his recent dream studies, emphasizes that the manifest content of the dream is an "index of the quantitative balance between repressed and repressing forces" (7). And in another (8)

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and also overdeterminations are not emphasized as it would be necessary in the actual course of a psychoanalysis. The material is reduced to a few underlying determinants—to the instinctual biological tendencies.

The tentative conclusions utilized for the predictions of the hormonal state were also checked in another way. One of us studied the vaginal smears of unanalyzed cases. Those cases gave a day-by-day report of their conscious emotional state and report their dreams on a questionnaire. The material was submitted for psychological study and it was possible to determine in which phase of the cycle the dream occurred.

The aim of our investigations was to describe the emotional states as they are correlated with the hormonal states. The results show that the emotional states, as expressions of the underlying instinctual tendencies, easily coordinate with the conception of the instinct theory of psychoanalysis. Hence in these investigations which offer the first laboratory results to support the theoretical concepts of psychoanalysis, the terminology of the instinct theory is introduced. The meaning of the terms will be apparent from the context, but it may be useful to give a few definitions at once.

Libido is the psychic energy supplied by sexual drive.

Active-passive designates the direction of the drive. If its goal is achieved by action, it is called active. When the goal is achieved by experiencing activity of another person, it is called passive.

Object libido is the instinctual tendency directed toward another individual for its gratification.

Heterosexual object libido expresses a desire toward an individual of the opposite sex.

Narcissism is the psychic condition in

which the sexual energy is concentrated on one's self.

Auto eroticism is the process of gratification of the narcissism.

Genital phase of libido organization designates the capacity of normal adults to experience full sexual gratification (orgasm) by normal heterosexual intercourse. The genital phase is characterized by the full acceptance of, and by the desire for, the genital organ of a person of the other sex, as the object of gratification of one's own genital drives.

The Libido Theory differentiates several phases of the instinctual development previous to the genital phase; for instance, oral.

"Oral" connects the so circumscribed subject with a sensation experienced on the mouth: oral gratification, oral aggression.

Oral receptivity is the term of the passive need of being fed. In the passive state of early infancy this need is experienced together with the passive need of being sheltered and taken care of. We refer to this attitude with the term *oral dependency*.

Anal eroticism refers to erotic pleasure derived from the anal region.

DATA AND DISCUSSION

Follicle Ripening Phase: Oesterone is the hormone produced by the ripening follicle; it makes the animal ready for and desirous of copulation. The conscious and even more the unconscious psychological material during the phase of follicle development deals with the heterosexual tendencies of the woman. It is impossible to give a full account of all the ways in which heterosexual tendencies can appear in psychological material. Our comparative material shows clearly how complicated it may appear in the emotional state of women.

The feeling of incipient oestrogenous tension is chiefly one of well-being. The patients say that they feel

young, alert, that they can work well and think more clearly. For example, case G.S. 8/9/37:

"This morning I felt seventeen years old so far as my mood was concerned. I met C. I felt sexually attracted to him which I did not feel when I met him last time".

The vaginal smear 8/9/37 shows cornification about the 50 per cent level; moderate leucocytosis and mucous output. The basal body temperature is significant only in relation to the entire temperature curve for cycle and will therefore be presented in that form in the charts of the summary.

On September 4th, the same patient says:

"I was energetic and active. I felt quite well".

The dream of September 5th allows the following interpretation: She wants to be a good looking woman, attractive to men, and able to handle her sexual temptations. This is an obvious expression of incipient heterosexual tension. On the following day, September 6th, the patient describes her mood at a picnic:

"I felt very young and carefree. I liked everybody. I climbed on a tree. I sang. I did not have any selfconsciousness about my body".

At about the same phase of another cycle, on January 18th, the patient had the following dream:

"Mike came and paid me a lot of attention. I was aware that he was a writer and I was flattered that he had singled me out. He embraced me and fondled me a great deal and I responded".

The vaginal smear 9/6/37 and 1/18/38 showed 50 per cent cornification, moderate leucocytosis and mucous output.

The psychic energy corresponding with oestrone production can be characterised as follows: It is active, directed from the individual as libido

center toward the object, just as Freud originally described object-libido (11, 12). The active libidinous desires are directed toward sexual objects in the patient's sphere of action. This active libido may be expressed not only as heterosexual tendencies but also by increased strength of the ego in maintaining self-regard, object-relationship, and more active defenses of the ego toward the outer world. It increases during this phase of the cycle and supplies the ego with an active quality. The ego in this phase of the cycle is more charged with an active energy which seems to prove Freud's conception (12) that Eros is the energy which unites the parts to a higher organisation. Detailed study of the psychodynamics of individual cases in relation to their menstrual cycles, which could demonstrate what is meant, must be deferred to a later publication.

Although the active charge of the ego is productive and agreeable, it can, when no gratification or transformation into satisfactory activities is permitted, be converted into a disagreeable tension,—restlessness and irritability, which are an expression of the dammed-up, originally libidinous charges. With increasing hormone production the ungratified active charge may achieve psychological expression in the form of aggression directed toward the male. Thus in our material which is chiefly pathological, there is only a brief period when the initial low hormone content is associated with an agreeable libidinous state. It often develops into a tense emotional state in which the psychological material is characterised by aggressive tendencies or by anxiety. The emotional state may be dominated by fear of being attacked sexually. The following dream of Case L. (9/12/38) demonstrates unmistakably that increased heterosexual tension may be accompanied by fear:

"Some huge fossil belonging to the reptile family, mounted, standing upright in the museum. Some remark or other brought it to life and it began to crawl over the land. People fled before it in terror. Very slimy and shining ugly green. I think it punctured the tire of an automobile and then proceeded to attack the occupant. The dream woke me up".

The vaginal smear 9/12/38 indicates that this was the peak of oestrogenous activity in the cycle.

In this dream, even though the snake symbolism is disguised, it is clearly enough a penis symbol in which even the function of erection is easily recognised when the dream describes how this fossil became alive and then dangerous. The ambivalent attitude of the dreamer toward the penis is very clear—admiration is expressed by exaggeration of its size and power; fear and revulsion is expressed by its becoming ugly and revolting. The tension in the dream increased so much that the dreamer awoke. Patient R.E. on 2/11/38 relates the following dream, very typical for her:

"The thing I was afraid to think about or to talk about, the thing that stands out clearly is that there was a bed and no one was in the room except for my father and myself. He was trying to urge me to have intercourse with him. He was shoving me to the bed and I was moving toward it. I was willing. Then suddenly it occurred to me: 'It is my father'. I was ashamed. It was frightening. He was right after me. I do not want to think of it".

The vaginal smear 2/11/38 shows about 90 per cent cornification and minimal evidence of aggregation and folding. It is probably a smear of the preovulatory phase.

Very often increased oestrone production leads to aggression which in dream material may appear as penis envy, or as an intense wish to castrate the male or to incorporate the penis and become a male. Clear tendencies

toward masculine identification and masculine competition are often observed in the preovulatory state. How much oestrone tension a woman can stand without turning it into aggression depends upon various factors which can only be discussed in connection with the psychodynamic structure of each case individually. It is self evident that actual sex experiences, gratification or disappointment, may influence the psychological reaction. For example, Patient V.M. reported a dream on 12/1/37:

"A man rolls a cigarette, a large one. Then the cigarette is being sliced off, like plates or drops. I was conscious of its dryness".

The vaginal smear 12/1/37 consists of purely cornified cells with only an occasional red blood cell and indicates extreme oestrone production, which usually precedes ovulation.

It needs no deep interpretation of the above dream to sense the hostile, castrative, depreciative attitude toward men. This is emphasised more strongly by the associations. At the same time the patient seeks gratification by promiscuous sexual relations. It is obviously a preovulatory tension.

We now present the preovulatory phase of a single patient from its inception right through ovulation. Patient G.S. on 12/17/37 expresses a heterosexual wish but with a helpless feeling and wants to be helped.

The vaginal smear 12/17/37 shows beginning cornification.

On the night of 12/18/37 the patient dreams:

"My nose or someone's nose was smashed, or perhaps a skull. Immediately on awakening I thought of a face all swathed in bandages. It was our coalman whom I had seen in a coffin when I was a young child".

The vaginal smear 12/18/37 shows in-

creasing cornification to about the 75 per cent level.

The destructive aggressive tendency is easily recognized as a character of preovulatory tension. On December 19th she dreamed:

"Of a head that was cut off or hanging connected with a holiday candle".

The vaginal smear 12/19/37 shows cornification at about the 90 per cent level with abundant mucous and progressive reduction in the number of leucocytes—clearly preovulatory.

In this dream the aggressive tendency of the previous dream is repeated. The patient described her emotional condition of 12/20/37 as follows:

"I feel rotten. I have a dull headache. I was disgusted with you. I was furiously angry".

And on 12/21/37 she reported a dream:

"I felt a temper tantrum, breaking things and shaking with rage. My *oldest sister K.*, my *youngest sister R.*, and I were together. R. was critical. K. was studying what was the matter with me. I yelled to R.: 'You are afraid of me. You think that I am insane. If I were insane I would not show it to you'. I felt weak in the dream. I had the feeling I was dissipating my energy in fruitless rage".

The vaginal smear 12/21/37 shows 100 per cent cornification, leucopenia, beginning aggregation and folding. This is a smear which signals impending ovulation.

Ovulatory State: As we observed in the last few examples the psychological changes related to the production of oestrone developed gradually or in sudden leaps to their highest point, when the ripe follicle may burst and ovulation occurs. However before ovulation does occur, lutein activity begins. The very first evidence of function of the corpus luteum is a change in direction of metabolic activity, and is reflected by corresponding change in

the psychodynamic tendencies. The examples, cited above showed the heterosexual interest with its various emotional expressions, such as love, fear, and hostility. When the function of the corpus luteum hormone—progesterone—begins, this exclusive interest in man changes immediately. The heterosexual tendency appears combined with passive, receptive instinctual tendencies. The psychoanalytic material reflects the libidinous interest in one's own body. The emotional interest is self-centered. The woman appears more passive and dependent.

Patient V.M. on 3/15/38 has the following dream:

"I was coming down the steps with Jack carrying a creature which I decided was a baby. It was not the proper way to carry it. The baby was not properly dressed. I was sure it was a girl. But to my surprise it was a boy. I felt badly since I wanted a girl. I felt so badly, I considered cutting off its penis. I could not accept it as my child, having a penis".

The vaginal smear 3/15/38 shows complete cornification, folding and aggregation corresponding to ovulation.

This dream expresses a great conflict tension, the solution to which is castration of her own child. The dream solution shows the direction of the instinctual conflict, which is here aggression toward the penis. We distinguish in this manifest dream first, the first dream thought, which shows ambivalence toward the child. In the second dream thought the wish to have a daughter is expressed (the associations emphasised the wish to have a daughter more beautiful and more feminine than the patient herself). These two dream-thoughts show a content which we correlate with the lutein activity. Then the conflict shifts to the aggression toward the boy, toward the penis. The aggression toward the penis is the predominant direction of instinctual tend-

ency in this dream because it offers the dream solution. Therefore, the incipient lutein activity and stronger oestrone tension was diagnosed: = *pre-ovulative tension*.

On 6/24/38 patient R.G. reported:

"Yesterday evening I had a bad spell of eating and today too. Today I ate a very adequate lunch and slept an hour and awoke hungry. I thought of my brother. I felt I wanted to destroy his genitals. Well, it is a real wish. To pull him out. The thing that bothers me so much is that I still have the wish to do it. I connect it with the fact that my mother used to tell me that she'd cut my thumb off when I used to suck it".

"It is as if I almost want to feel depressed".

"This day after the analytic hour was the worst day I ever had. After I finished lunch I had a terrific craving for candy. I got quite depressed".

The vaginal smear 6/24/38 shows 80 per cent cornification with minimal folding and aggregation, indicative of the incipient luteinization, but chiefly preovulative.

This example of craving together with the wish to incorporate the penis shows the reaction of this patient to the preovulative state: to the increased oestrone and incipient lutein function.

Our observations so far permit the statement that our patients can handle their hormone balance psychologically much better as long as only one of the hormones is active. In the case of a normal woman with normal sex life increased heterosexual tension is usually relieved by sexual gratification. Thus the preovulative tension will not achieve a level at which symptoms develop. Most of our cases however do not find complete sexual gratification even when they have heterosexual relationships. The emotional expressions of this state turn into great tenseness or depression, irritability and sensitivity, weeping spells and rage reac-

tions. An insatiable need for some type of gratification develops. Cravings and incorporative wishes of all kinds appear and lead to sadistic and masochistic tendencies which occur chiefly when both oestrone and progesterone are active. When ovulation actually occurs the tension is suddenly relieved and relaxation takes place. We now present some examples of ovulative change.

Ovulative Change: The psychoanalytic material and corresponding endocrine findings of Case G.S. from 12/17/37 to 12/21/37 were cited above as an example of aggressive tendencies which developed during the period of increasing preovulative tension. The dream of 12/21/37 *q.v.* shows homosexual content also, corresponding to incipient corpus luteum activity; the smear was called immediately preovulative. On 12/22/37 she reported the following dream:

"Young girl. She talked in a very facetious way. She must, must be me. This girl talked with a man who had flaming red hair, curly lashes. He was interested in this girl and made a date with her. I talked to the girl. I told her about a case. Someone was pregnant and the man did not assume responsibility. I told her men don't like to do this. She answered, 'Is that so? Do you mean this really?' In the same dream somebody said, 'He is very VERY HURT'".

The vaginal smear 12/22/37 shows marked desquamation and leucocytic infiltration typical of the first postovulative day.

In this dream it is obvious that sexual temptation is directly connected with the danger of being impregnated and then abandoned. "He is very hurt" is the expression of her wish for revenge as well as the projection of her own being hurt. The dream shows marked heterosexual wish, expression of oestrone activity, and fear of pregnancy, expression of lutein activity, and there-

fore might be interpreted as clearly preovulatory. During the analytic hour on 12/22/37 the patient feels relaxed. She starts her associations jokingly: "Oh, my dear—It is a hard job to overcome an inertia against talking". During this hour she talks about her admiration for her body, how she used to stand in front of the mirror admiring herself. She talks in a relaxed, receptive mood about her need for being loved. But she brings up bitter associations about men who do not love her as she wanted to be loved. The mood and content of the hour clearly show the post-ovulatory relaxation and narcissistic gratification. On 12/23/37 the patient says:

"I functioned well yesterday. I loved myself very well, on the basis if nobody else loves me I will love myself. Yesterday evening I was pleased with my body. My husband made overtures but I felt removed from him. I loved my breast. I did not want him to touch it. Though my body was burning for love I withdrew".

This recital of her emotions shows that her libidinous interest was withdrawn from the outerworld and centered on her own self, which is not an individual characteristic of this patient but may be found more or less clearly expressed in all cases after ovulation occurred. The management of this erotisation by withdrawal from the heterosexual partner has however individual significance, the consequences of which can be seen on the next day. The relaxation and happiness was of short duration, for on the night of 12/23/37 she dreamed:

"Jim's mother was walking with Jimmy. We were on the railroad tracks—I and Jim. Suddenly the child dropped his mother's hand and dashed toward the tracks, threw himself on the rails and rolled about. When my sister on the other side saw the child she shrieked".

The vaginal smear 12/23/37 is clearly postovulatory.

In this dream the patient's aggression toward her own child is evident. The associations during the analytic hour showed that the dreamed suicide attempt of the son is a substitute for her own suicide wish. She identified herself with her son. The apparent aggression developed toward her own pregnancy and is really an aggression toward herself. The aggression which was directed toward the man's penis during previous days 12/19 and 12/20 is now directed, after incorporation of the penis, *i.e.* pregnancy, toward the son, and therefore toward herself. The introversion of the aggression is indicative. It supports the general observation that the psychic energy which was directed toward the object world during the preovulatory phase is turned toward the patient's self in the post-ovulatory phase of the cycle.

It is interesting to compare this ovulatory state with the following cycle of the same individual. We have already cited the pleasant erotic sensation associated with minimal oestrone activity which persisted from 1/18/38 to 1/20/38 of G.S. On 1/20/38 she had many symptoms: perspiration, irritation of the rectum. In fantasy she identified herself with prostitutes and became extremely angry and hostile toward all authorities.

The vaginal smear 1/21/38 shows complete cornification.

On 1/22/38 she forgot the main part of her dream. The fragment which she remembered had homosexual content. During the analytic session she was excited. Her fantasies were aggressively directed toward the penis which she wanted to pull and incorporate.

The vaginal smear on 1/22/38 was clearly ovulatory, showing complete corni-

fication, minimal folding, with leucopenia, similar to the smear on 12/21/37.

After the analytic session the patient had a dream which contained an involved argument with her mother about the feminine rôle. The dream showed an intense dynamic conflict between the wish to be like her mother, (*i.e.*, accept the motherly rôle) and the overwhelmingly powerful sexual desires which expressed themselves in prostitution fantasies which is the opposite of motherliness. The dream permitted the conclusion that although there was an increasing tendency toward accepting the mother rôle, heterosexual tension was nevertheless maintained, therefore the diagnosis of pre-ovulatory state was made.

On the next day 1/23/38 she felt weak, "like a baby—my hands look washed out—I ate a great deal, slept a great deal".

The vaginal smear on 1/23/38 was clearly postovulatory and showed marked desquamation of cornified cells and leucocytic infiltration.

On 1/24/38 her dream showed identification with her child but not in the suicidal aggressive manner of the preceding month, rather in a positive, satisfactory attitude of being proud of the son. The last part of the dream expressed various hostile impulses in connection with pregnancy.

The vaginal smear 1/24/38 showed definite luteal phase with reappearance of a few normal cells and increased mucification of all cells.

Thus postovulatory relaxation on 1/23/38 was accompanied by a regression, being weak like a baby, sleeping, and eating like a baby. The oral dependency, the need for love, as well as the awareness of her own genitals were manifest in symptoms and in conscious feelings. They express the need to be close to the mother like a baby, to be

protected by love and gratified by food. The change from the aggressive incorporative, preovulatory tension to post-ovulatory relaxation and oral regression (identification with infant) can be observed in this cycle which shows some psychological improvement as compared to the previous cycle.

These two subsequent ovulatory periods of one patient may suffice to demonstrate that the instinctual tendency changes its direction after ovulation took place. While it was active, and directed toward the sexual object during the follicle-ripening phase, it becomes passive and directed toward one's own self after ovulation. Further examples of other patients with quite different personality structures make it evident, that the change in direction of the instinctual tendency is not characteristic of any individual case but is found generally.

A patient, R.E. with severe phobia, and passive infantile personality had two dreams in the same night, 11/1/37.

"My husband, my sister and myself were at a show and on the screen two shots were fired. Someone was getting killed or there was a war or something. Anyhow some shots were fired. I heard somebody in the audience sort of scream in Jewish 'Oi veh' as though she couldn't stand the shooting on the screen. The voice was very familiar to me. I turned around. It was my mother standing in the aisle hollering at the top of her voice. I was very embarrassed. I sort of pulled her toward where we were sitting on the aisle. I felt embarrassed and kind of funny about having people know it was my mother screaming that way. I asked where my brother was that stays with her. She pointed to him sitting in a seat all by himself. She said 'He's sick'. He had his hand holding his forehead and I got scared and went up to him and asked him what was the matter. I don't remember whether he was sick or he was sleeping, and I don't remember and don't know the end of it."

This dream shows the fearful defense against heterosexuality. The aggressive scene in which the mother is desperately wailing is the typical representation of her early experience of the parents' coitus. In the dream it is partly projected to the screen, which decreases the own fear of being attacked sexually. The next dream-thought considers the brother. (She experienced the sexual attack of the brother in childhood.) But now he is sleepy or sick—he is now not dangerous. Thus she can act in a motherly fashion and take a kindly interest in his condition. This last part of the dream shows a motherly attitude. The next dream in the same night shows impregnation symbolism on an infantile, oral level.

"I was in my sister's house eating fried fish and a baked potato. I was on very good terms with her. All of a sudden I heard a loud noise outside, people hollering and screaming, and I thought it was my mother so I ran out to see who it was. There were some people on the street fighting,—police officers with guns in their hands and clubs. I couldn't find my mother. I thought it was her doing all the screaming. I looked around for her. I came back to my sister-in-law's, but the baked potato was gone."

"Only the fish was left. But she had eaten the baked potato. I asked her if she had enough fish for supper. She showed me a platter with enough fish for supper and in the dream I wondered why I was speaking to her when I'm supposed to be angry at her. Then I remembered that some woman with whom I played poker said 'You'll be speaking to her soon'. That thought of what this woman really said came to me in the dream. So that was the end of it".

In its manifest content the dream showed only a slightly disguised child-like conception of impregnation.⁴ The

⁴ Children have their own concepts as to how children are conceived and they cling to these fantasies very often even after they have full enlightenment as

first dream expresses the heterosexual tendency and beside this some motherliness; the second dream expresses the same tendencies, but the wish to be impregnated is stronger.

The vaginal smear 11/1/37, showed 100 per cent cornification, some folding and aggregation typical of the *ovulative phase*.

At the analytic hour on 11/1/37, oral regression seemed to dominate. The patient came like a child with a chocolate bar in her hand, eating, and offered some to the analyst. On 11/2/37 the analytic material showed increased fear of being attacked sexually. She recalled a dream fragment in which her husband had protected her against sexual aggression of other men and associated it with the sexual attack on her by her brother when she had been a child and to which she had reacted with the fear of being pregnant. This material is thus an elaboration of the problem expressed on the previous day.

The vaginal smear on 11/2/37, showed 100 per cent cornification plus folding and aggregation as on the previous day, still *ovulative phase*.

On 11/2/37 the patient could not take a basal metabolism test because she felt she was suffocating. On 11/3/37 she came into the analyst's office cheerful and relaxed. She recited the happenings of the previous day in a normal way, described her suffocation, her tenseness, her extreme irritability toward her husband. The entire session was filled with uninterrupted, free-flowing cheerful but rather empty talk. When the analytic session was finished she arose from the couch and asked proudly for praise because she "associated so freely" without being urged.

to the natural processes. Freud refers to these fantastic concepts of the children as infantile sexual theories. One of the most wide spread conceptions is that children are conceived after the mother eats something such as potatoes, beans, fish, etc.

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The vaginal smear, 11/3/37, was post-ovulative and showed leucocytic infiltration of the previously leucopenic vaginal mucosa.

The state of intense preovulative tension persisted from 10/31 to 11/3. The heterosexual tendency of this period was masked by fear while the progesterone activity was expressed by wish for impregnation and regression to oral state. In another cycle of the same patient, on 1/18/38, the dream material was interpreted as *fear of impregnation*. During the analytic hour she felt peaceful, quiet, contented, tired and without fear.

The vaginal smear 1/18/38 showed complete cornification with minimal folding, probably a smear of the ovulative day.

The postovulative relaxation was clearly marked. On the next day 1/19/38 she reported:

"I had a dream about playing poker. We were going to play poker in one of the women's houses. My brother's wife was going to watch me. Even in the dream I knew I was afraid to be alone. She took the baby along. She was going to give her some milk for lunch. I asked her 'Is that all you are going to give her? Why that isn't enough. It's very hungry'. My brother loved the baby a good deal and if anything happened to the baby, if she didn't get enough to eat it would be my fault and I'd be blamed by him. So I asked the hostess if she had any eggs and she said they don't eat eggs in her home. I was sorry that I didn't take one along with me from my mother-in-law's because I knew that she had eggs".

The vaginal smear 1/19/38 shows marked desquamation of cells and a slight regression from the complete cornification of the previous day, clearly postovulative.

The dream has a slight heterosexual content. The patient cannot indulge in sexuality because she is jealously watched but in the dream her brother's

baby is her baby. Here we see the same wish to have a child, as we found it in the material on 11/1/37 and 11/2/37. Here is repeated again the competitive attitude toward the mother. When she is the mother, she feeds the baby more and better than the real mother does. She also shows the tendency to identify herself with the child whom she feeds as she wants to be fed and taken care of.

The ovulative change of patient V.M. may be presented here. Her dream of 12/1/37 we have already reported *q.v.* as an example of increased heterosexual tension in the preovulative phase. On 12/2/37 she reports:

"I hate my mother. She likes to talk about intimate things. I don't want her to be that close to me. I have an unpleasant feeling in my vulva when my mother talks of intimate things".

The vaginal smear 12/2/37 was clearly ovulative and showed complete cornification, leucopenia and an occasional red blood cell.

The change of heterosexual tendencies into a clear awareness of her own body and into conflict with her mother might be characteristic of the ovulative and early postovulative state. This material exposes, however, still too much active hostile feeling toward the mother and the dream as well as the associations during the analytic session fail to show relaxation. Even though the "mother conflict" is estimated as corresponding to lutein activity, on the basis of this hostile tension, the diagnosis of preovulative tension with increased corpus luteum function was made. On the next day, however, she reported the following dream (the patient is analyzed by a man).

"You and I were sitting in an operating room. You said that an operation would take place, and that the cost would be fifty dollars. I felt very thankful and thought it

was worth any price. I thought that the operation was to be on my throat". The vaginal smear 12/3/37 showed continued cornification but beginning aggregation indicative of ovulation.

Comparing this dream with that of 12/1/37 the difference in direction of the psychic energy is obvious. On 12/1/37 the patient dreamed that a man's penis was being sliced, while on 12/3/37 she yields to a passive masochistic feminine tendency. Gratitude instead of vindictiveness is an evidence of relaxation which permits the conclusion that the characteristic post-ovulatory emotional state had developed. The psychoanalytic hour offered further evidence for relaxation. The flow of associations started playfully:

"Humpty dumpty sitting on a wall. Wiener frankfurter my favorite food".

In another cycle V.M. on 10/13/37 felt tense. Her dream expressed a strong defense against the feminine sexual rôle and an intense wish for masculine identification.

The vaginal smear 10/13/37, was ovulatory and showed 100 per cent cornification, with some folding and aggregation.

On the next day 10/14/37 the patient was depressed and calm. She wanted to be taken care of, to be nursed by her husband. This passive dependent attitude expresses the regression which we consider characteristic of early postovulatory phase.

The vaginal smear 10/14/37 showed increased desquamation and aggregation, clearly postovulatory.

This brief selection of psychological material of the ovulatory state demonstrates the main correlation. Other cycles investigated show the same correlations but the underlying psychodynamics assumed a more complicated form. This material has displayed the

increasing intensity of conflicting psychodynamic tendencies during the pre-ovulatory state, when both oestrone and progesterone were present in the organism. It should be emphasized that the basic unconscious conflicts of the individual come closer to consciousness during this period of the cycle. Very often dreams and the conscious emotional attitudes do not adequately discharge the tensions. Symptoms increase in intensity and new symptoms develop. The characteristic symptomatology of this period we shall defer to a later publication.

The ovulation is characterised by the sudden decrease of oestrogenous activity and by the increased activity of corpus luteum. Hence, after ovulation the active heterosexual libido decreases and the passive libidinous tendencies appear with greater intensity. Emotionally this state is mainly characterised by the relaxation of the preovulatory tension, which was caused by the conflicting tendencies of oestrone and incipient lutein activity.

Our examples have demonstrated the relaxation which follows ovulation. This relaxation has various emotional concomitants. Sometimes the patient becomes talkative or even hypomanic. Preovulatory and postovulatory talkativeness are distinctly different. Tense, speedy talk with increasing sensitiveness, with the patient suffering from the feeling of being compelled or driven to talk is characteristic of the preovulatory state. Satisfied, pleasant, relatively passive free flow of associations distinguishes the postovulatory state. The most valid psychological sign of ovulation is a relaxed feeling of well-being which is accompanied by positive, pleasant feelings about the subject's own body, for example: V.M. on 12/7/37 feels well and relaxed. She enjoys herself passively during the analytic hour and tells:

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"I saw my breasts, I wanted to be recognized as a woman. The sexual feeling I had was going through my breasts. I put my arm around myself and I remember the sensation in my breasts, the sensation of shame".

On the basis of the narcissistic sensations, the diagnosis of "postovulative" was made.

The vaginal smear 12/7/37 was definitely postovulative and showed marked desquamation and aggregation of cornified cells.

The very similar material of G.S. on 12/22/37 was already cited—as falling in love with her own body. On 10/5/37 she describes her emotional state in another postovulative period as follows:

"I feel young, alert, and unantagonistic".

The vaginal smear, 10/5/37, showed increased aggregation and secretion. Very few cornified cells; clearly postovulative.

A gratified warm feeling follows the great tension. In the postovulative condition the body is flooded with libidinous feelings. This erotisation of the patient's own body may be conveyed to other persons too: A need for closeness, for love in a general sense is the emotional expression of this hormonal state.

The relaxation may express itself as a sudden regression, such as we saw in G.S. on 1/23/38 when she felt her body "weak and passive like a baby", sleepy and hungry; or in V.M. on 10/14/37 who acted out her wishes for dependence and her desire to be nursed and taken care of; or in R.E. 11/1/37 who acted out the regressive oral condition by coming with a chocolate bar in hand to the analytic session.

The immediately postovulative state is also characterised by an increased libidinous charge of the propagative organs. This charge is frequently strong enough to result in a conscious aware-

ness of the patient's own genitals. It may also be expanded to include the entire body. The reaction to this feeling is normally pleasant. It may give rise to strong feminine exhibitionistic tendencies, to the wish to dance alone, e.g. in V.M. on 3/17/38. The increased sexual charge may result in masturbation or may give rise to defense against being a woman and arouses inferiority feeling.

Lutein Phase: The attitude increases during the ovulation phase, and thereafter the psychodynamic material is either narcissistic or clearly passive-receptive, typical of the female and the small child. The passive receptive tendency determines the psychodynamic situation as long as progesterone dominance persists. Progesterone is the hormone chiefly concerned with preparation of the uterus for nidation and with maintaining pregnancy. The physiological preparation of the uterus for nidation implies a task for the psychic apparatus to be dealt with in every cycle, namely to solve the problem of being a woman. While the activity of the corpus luteum increases, we observe in the psychological material the attempt of the individual to prepare herself for the propagative rôle of womanhood. During the study of the psychological material related to the menstrual cycle it was striking to see that under the influence of corpus luteum activity the psychological material shifts to the mother-conflict, to the problems of the relationship with the mother. For example, V.M. reported on 2/22/38:

"A hotel. Lots of strange people. I was afraid of them. My mother was with me. Mother and I picked up drawers and took them to the kitchen. A young man was then laughing at my mother. I went to help her. Somebody laughed at me. I decided not to pay any attention. I began to feel affection for her. I began to feel like rubbing myself against her leg. She seemed to

be bothered by it. I did it more openly and then decided she was my mother. She became disgusted with me".

Associations: "My mother in the dream was much younger. Something about the way she treated me caused a peculiar feeling inside. She was afraid other people would see it. I remember her sitting on the floor playing dolls with me when I was 6 years of age. Her face in the dream was more like then. I have a feeling my mother was very lovely. I never could feel like a woman should feel. I have a very unlovely feeling most of the time. The only time I feel that way (womanly) is in a nightgown that I like. As soon as I look in the glass it cancels the feeling I get".

The vaginal smear on 2/22/38 showed marked aggregation and folding, with gradual disappearance of cornified cells, typical of luteal phase.

The outstanding feature of the dream is the relationship to the mother. The solution of the dream problem is to separate the mother from her heterosexual interests and possess her entire attention, even in the sense of physical gratification. In this material the longing to have positive undisturbed feminine feelings toward her own body is also obvious. This tendency is typical for the undisturbed lutein state.

On 2/23/38—the *dream* shows homosexual content: One part of it is:

"I finally said the woman can come and sleep with me".

The vaginal smear on 2/23/38—typical for lutein phase, all the signs of lutein function increase beyond the previous day.

The emotional state corresponding to lutein activity is not always so happy and gratified as this material indicates. Here the patient was able to develop her fantasy of being accepted and loved by the mother. The same patient on 5/23/38 is depressed, cries, does not know what to do. She feels unwanted and unloved. She complains that the analyst does not love her

either. The patient is pleading for the analyst's love,—understanding.

The vaginal smear on 5/23/38 aggregation and folding of desquamated, cornified cells typical of progesterone activity.

On 5/24/38 the patient feels the same disappointment because of lack of love. She comforts herself with the fantasy and associations that her mother kissed her buttocks when she was a baby.

The vaginal smear on 5/24/38 shows increased aggregation—lutein phase.

We have already followed the cycle of G.S. which started on 12/10/37 through the very aggressive preovulatory phase, through ovulation on 12/22—12/23/37 which was marked by an intense but short-lived narcissistic relaxation; after which the patient became tense and depressed again. On the night of 12/24/37 she has the following dream:

"We were on our way somewhere and had been admitted to a home. We were going through the house, and talking in a friendly fashion to the children in the house. One part of the house appeared locked against us, but we were able to wander through the other rooms which were light, spacious and somewhat cluttered up. It appeared to me that it was necessary for us to go. Suddenly my mother appeared in a bathrobe. She had J., my son, in a bathtub filled with water. She appeared very intense. The other people and I watched with interest what occurred and were surprised. My mother kept pressing the child down in the water. He was completely submerged, struggled for a while and then lay quite still under the water, as though lifeless".

The vaginal smear on 12/25/37 showed marked aggregation with only an occasional cornified cell and was typical of the luteal phase.

In these general interpretations of the correlations between emotional state and hormonal state, case histories

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have been purposely omitted. At this point, however, it is necessary to state that in this case the aggressive impulses toward the pregnancy and the infant were indeed the central conflict which resulted in depression. In spite of this, reviewing the dream material of this cycle we recognize that the conflict of the patient is not apparent in the psychological material of the preovulatory phase. The aggressive impulses in the dreams of the preovulatory state were directed toward the man; (Dreams on 12/18/37 and 12/21/37) they increased to rage in the dream 12/21/37 and then the ovulation occurred accompanied by emotional relaxation. After the ovulation the aggression turned toward herself and toward her child in the dream (12/23/37). In this last dream the conflict with the mother is obviously expressed. She was afraid of her mother, because she was rejected by her. In the manifest dream the mother kills her child in water in a bathtub. The aggressive impulse is here passively experienced. The passive direction of the instinctual tendency, the repetition of the conflict with the mother and with the child are those contents of the dream which we correlate with the intensified function of the corpus luteum. It is comprehensible that after this dream patient feels tense and remarks: "I was aware of all my nerves, even those in my ears". The awareness of her female body burdened by fear of the mother's aggression toward her and by the guilt for her own aggression toward her child charge the problem of mother-child with fear, aggression and guilt.

The complicated interrelationship between mother and daughter (from the beginning of life) is the subject of psychoanalytic investigation of individual development. The conflicts vary in depth and structure in every case and change during the course of psy-

choanalytic therapy. It is not germane to this paper to describe the different types of conflict or their changes during analysis—tending toward reconciliation with the mother—except for the following point: as long as the unconscious relationship to the mother is hostile the oral material becomes aggressive and tensions develop which destroy all the pleasant passive-dependent narcissistic feelings which were found to be characteristic of the post-ovulatory state. Thus hostility leads to more or less severe depression during the lutein phase as for example in G.S. 12/25/37 and in V.M. 5/23/38 *q.v.*

The psychological material corresponding to the activity of the corpus luteum would in the usual psychoanalytic terminology be described as belonging to the pregenital, oral level of libido organisation. From the cycles we have studied, we may describe the course of instinctual tendency as follows: after maintaining active heterosexual libido directed toward the object on a genital level for a period of time (oestrone phase), the libido changes its direction and appears as a passive receptive tendency which, during the preovulatory state may conflict with the heterosexual object libido. The passive receptive tendency becomes stronger after ovulation. The earliest object of the passive receptive libido was the mother who satisfied all needs of dependence, the need to be loved, sheltered and fed. We dare say that passive oral-receptive tendencies appear in the psychological material of an adult woman only when progesterone is present. Of course it is possible to observe "oral material" in the follicle-ripening phase of the cycle as well, for then the aggressive incorporative tendencies serve the purpose of masculine identification. The distinction between passive receptive and

aggressive incorporative oral tendencies⁶ is important in recognising the various phases of the cycle. The former belongs to the postovulatory, the latter to the preovulatory phase.

The passive receptive tendency of the corpus luteum phase has its normal emotional representation on the genital level: this is the wish to be impregnated, the wish to have a child. The tendency toward nursing and feeding appears often parallel with this wish. Thus the passive receptive genital desire manifests itself in connection with an active oral,—“oral-giving” tendency: with the desire to feed. Both intellectual tendencies unfold after successful identification with the mother. Hence in dreams and in the other psychological material they appear together with the wish to be like the mother. Between these extremes 1) the wish to be a baby and be nursed and fed by the mother, and 2) the wish to be a woman, be impregnated and become a mother, we find all the varieties of female development. The biological preparation for pregnancy is reflected in the psychological material as pregnancy fantasies or dreams and appears sometimes as the early expression of corpus luteum activity even in the preovulatory state. Such early pregnancy material is however projected to the mother as for example in R.E. on 11/2/37 and in R.G. on 6/26/38 *q.v.* Such pregnancy material is referred to mother's pregnancies and may be expressed by birth fantasies or womb fantasies. It may repeat the conflicts and traumata caused by birth of siblings, as for example in R.E. on 1/19/38.

⁶ This distinction of the oral tendencies in oral receptive and oral aggressive, as well as the distinction of the oral dependency was worked out mainly by Dr. Franz Alexander in his Vector conception, (1, 2, 3). These investigations confirm his findings on a larger scale.

The psychological material corresponding to late progesterone activity shifts from the conflict with the mother to the problem of being a mother and to the relationship with the child. Pregnancy material is then concerned with the problems of their own pregnancy (not that of the mother), the fear and desire. The wish to nurse, feed, and take care of the child is characteristic of very late corpus luteum activity. This material can rarely be demonstrated apart from other factors which influence the cycle at this time. One such example is provided by G.S. on 1/28/38 (the earlier part of this cycle has already been cited).

“I seem to have been told that I could get clothes for a small child, but I forgot about it when I saw the child. I made preparations to cut its nails. The person in charge of the clothes came along and told me that I keep forgetting to take care of the clothes. Then we came to a place which looked like a kindergarten”.

The vaginal smear on 1/28/38 consists mostly of normal cells indicating very low hormone content.

Progesterone dominance persists only a few days unless pregnancy occurs. Otherwise the new follicle starts ripening and reflects its activity in the psychological material. With reappearance of oestrogenous activity there is again a period in which tendencies corresponding to both corpus luteum and follicle-ripening function influence the emotional state simultaneously, for example in V.M. on 12/8/37 (the ovulatory state from 12/1 to 12/3/37 has been presented before) the following dream is reported: (*male analyst*):

“I am in your office waiting for you. I wanted you to pay attention to me. I looked in the mirror. My hair was all white. My skin was smooth, my figure slender. I was dressed in a long velvet cloak. I thought you were punishing me by not looking at me, so I decided to go to the North Side. I

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went into a store on Milwaukee Avenue. I felt somebody changed things and I was tired out. I thought I would be late and that I should phone you. I decided to call you up at home. You were not there. Finally I went to your home. You lived in a little frame cottage. A little boy was in the window. I decided to save him and I did".

The vaginal smear on 12/8/37 shows together with the extreme aggregation typical of the luteal phase minimal cornification which is evidence of a newly ripening follicle—premenstrual.

In the beginning of the dream the satisfaction with her own body is expressed. She feels feminine and attractive. This part of the dream expresses the feelings which are associated with progesterone production. It is obvious that she directs her attractiveness toward a man with a normal heterosexual feeling. The heterosexual tendency is also expressed by fear of prostitution tendencies. The dream thought—"when my father does not love me I am like a lost child, in danger"—is another expression of the heterosexual tendency. There is sufficient heterosexuality to diagnose this as a premenstrual state.

We have already reported the lutein phase on 5/23/38 to 5/24/38 of V.M. showing conflict with her mother. On 5/25/38 still in a depressed and dependent mood, the patient reported the following dream: (*male analyst*):

"I changed my profession and got into school teaching. I went across the hall and put my hand on a child. I went down the corridor and saw my own son who did not belong here. Then I was here telling you about it. I became very angry because you did not give me a chance to express myself. A man and woman came in and you were angry at their coming. I began to cover up so she would not think that anything was going on. Then I decided I did not need to be scared because another man was there too".

The vaginal smear on 5/25/38 shows

initial cornification—premenstrual. The patient in this dream sought a solution for her dependence.

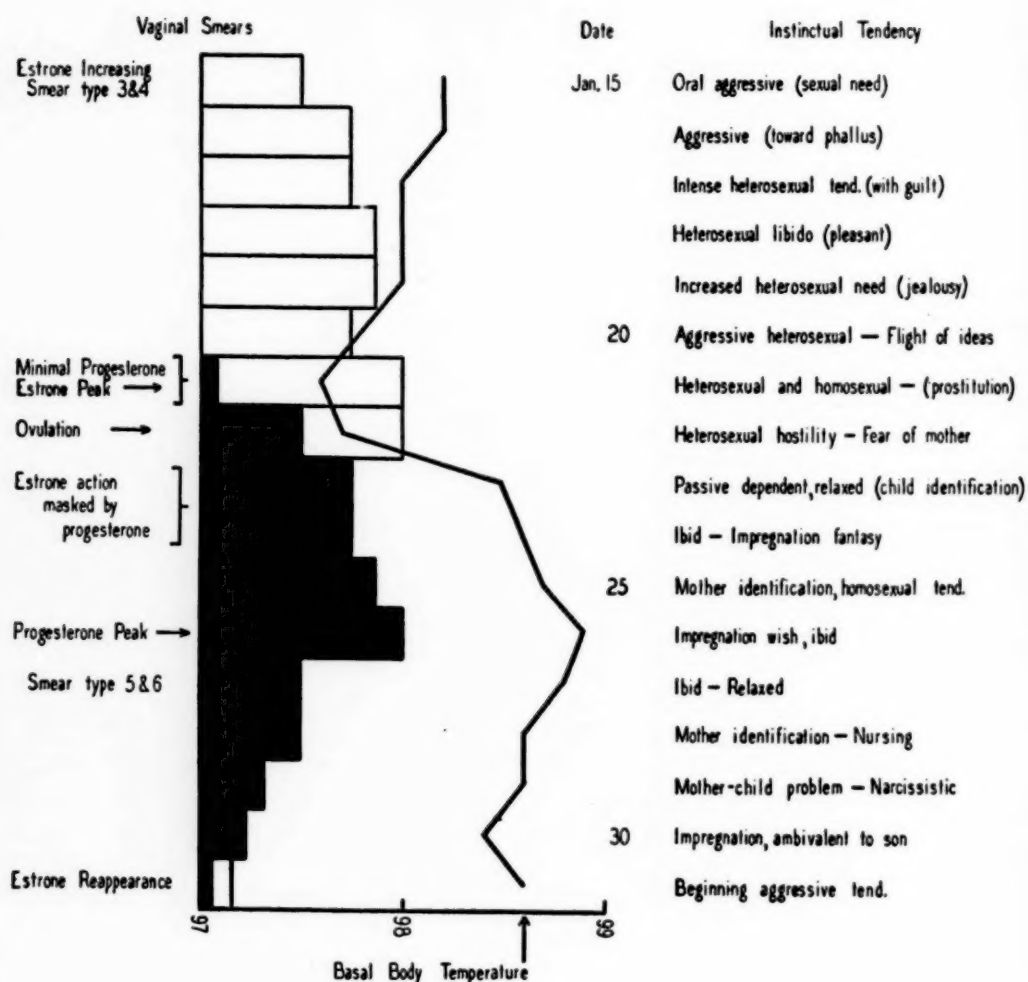
The only possible solution was to be a good mother and protective to her son. But the heterosexual wish toward the analyst-father whose attention she wants for herself interferes with her wish to be a good mother. The dream is therefore concerned with the mother-child relationship (lutein phase) and expresses heterosexual tendencies (newly ripening follicle).

The first evidence of premenstrual change is the consequence of a slight influx of oestrone which usually remains at a low level for some days. During this period the heterosexual content of the psychological material does not overshadow the material which is related to nidation. With further atresia of the corpus luteum and the consequent diminishing progesterone output, there is again a change in direction of metabolic processes. This is reflected in the psychological material. The psychological complexities of the premenstrual-menstrual phase, except at its very beginning, require more detailed description than can conveniently be included in the compass of the present paper. These complexities however can be correlated with the simultaneous hormonal complexities of this phase of the cycle as we plan to show in the second part of this publication.

SUMMARY

We have presented and discussed the psychological and physiological material of that part of the menstrual cycle which centers about ovulation: the preovulatory, ovulatory and post-ovulatory periods. The presentation of material of the premenstrual-menstrual phase will occur in the second part of

BASAL BODY TEMPERATURES, VAGINAL SMEARS AND INSTINCTUAL TENDENCY DURING ONE OVULATIVE PHASE OF PATIENT G.S.



GRAPH II

this publication. We present above a graphic summary of the ovulative phase of the cycle of one of our subjects, G.S. Jan. 15-30 as a type of all cycles in which ovulation occurs.

Careful study of vaginal smears and basal body-temperatures on the one hand, and of the psychoanalytic re-

records on the other, led us to infer the correlations presented in the following diagrams. In the light of the foregoing material, the diagrams are self-explanatory.

The content of these two diagrams may be repeated shortly in the following correlations:

DIAGRAM I

Hormone	Instinctual Tendency	Neurotic Elaborations of Tendency
Oestrone, Follicular hormone	Active object libido on genital level: heterosexual desire	1. Aggressive incorporative: penis envy, castration wish 2. Masochistic: masochistic concept of fe- male sexuality 3. Defense reactions: a) fear of being attacked b) masculine protest
Progesterone dominant Corpus luteum hormone	Passive receptive tendency on geni- tal level desire to be loved: and wish for impregnation:	Passive receptive tendency on regressive level: oral receptive and oral dependent wishes, may be directed toward a) mother b) homosexual object c) heterosexual object

DIAGRAM II

Phase of Cycle	Hormone State	Psychological Material
Follicle ripening	Initial oestrone function	Heterosexual tendency, usually pleasant, feeling of well being
Late preovulative	Increasing oestrone plus mini- mal progesterone	Relief by sexual gratification or increasing tension—conflicting tendencies (See Dia- gram I.)
Ovulative (immediately after ovulation)	Diminishing oestrone plus in- creasing progesterone	Relaxation of conflict tension. Erotization of female body, passive-receptive. Pleasant emotional state.
Post-ovulative, luteal	Progesterone dominance	See Diagram I, especially passive receptive tendencies and object libido toward mother or homosexual object.
Late luteal, early premen- strual	Diminishing progesterone plus resultant reappearance (unmask- ing) of oestrone effects	Recurrence of heterosexual tendency on mostly receptive level, and pregnancy fantasies

1) The oestrogenous phase of the cycle corresponds to an emotional condition characterized by active heterosexual libido. This appears normally as a wish for heterosexual gratification but it may turn into aggression toward the man or into a fearful defensive attitude. The psychological material during this phase of the cycle reflects the psychodynamic aspects of the relationship to man.

2) The function of the corpus luteum corresponds to the erotization of the female body. In this phase of the cycle the libido is turned from the outer world toward the individual which appears more passive and dependent. The psychological material during the stage of the corpus luteum reflects the erot-

ization of the female body and the preparation for motherhood.

3) The ovulation is characterized by sudden decrease of the oestrogenous activity and by the influx of the narcissistic erotization according to the greater activity of lutein hormones. Emotionally this state is mainly characterized by the relaxation of the pre-ovulative tension which was caused by the conflicting tendencies between the increased oestrone and incipient lutein activity.

CONCLUSIONS

1) The day-by-day study of vaginal smears and basal body temperatures provided a useful and enlightening

method for analysis of gonad function of adult women.

2) The psychoanalytic method could also be employed for a day-by-day study of the cycle of propagative function on the psychological level.

3) The simultaneous use of the two methods provided clear correlations between the physiological and psychological processes.

4) The investigation suggests that in the adult woman, it was possible to relate instinctual drives to specific hormone functions of the ovaries:

a) heterosexual tendency is correlated with oestrone activity.

b) passive receptive and narcissistic attitude is correlated with progesterone activity.

5) Whenever the metabolic gradient correlated with the specific gonadal hormones changes its direction or slope, the psychological material shows a change in direction of the instinctual drive.

6) This method affords an approach to the study of the biological foundations of instincts.

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AFFECTIVE STATES AND SKIN TEMPERATURE: EXPERIMENTAL STUDY OF SUBJECTS WITH "COLD HANDS" AND RAYNAUD'S SYNDROME*

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VARIATIONS IN SKIN TEMPERATURE may be taken as a representative sample of bodily activity correlated with changes in affective states. A fall in the volume (18, 25, 13, 2, 12, 4, 23, 17) or in the skin temperature (3) of the extremities in response to "mental work", stress, fear, and pain, and conversely, a rise in the volume or rise in the skin temperature with relaxation and sleep have been described (22, 24).

It is the aim of this investigation a) to study more intensively the affective states which are accompanied by skin temperature changes; b) to determine the degree and duration of the temperature change, and c) to ascertain the clinical significance of these reactions in subjects with cold hands and Raynaud's Syndrome.

The changes in skin temperature in the fingers under emotional stress may be large, may occur rapidly, and be quickly reversible. Since the hands are customarily exposed, no new or special psychological problem is introduced in measuring temperature changes in these parts. Further, since the radiometer (8) does not touch the skin, no local secondary change occurs at the site of measurement. In the following experiments 203 observations were made on 47 subjects of whom 19 were males and 28 females. A drop in the skin temperature of the fingers under emotional stress occurred in all but

three instances with two subjects. In the latter a rise in the temperature of the skin occurred. The amount and speed of change in skin temperature differed from subject to subject, but the cases selected for description illustrate the variety and magnitude of the reactions.

Method of Investigation: Special emphasis was placed in this investigation on the coordinated study of emotional and physiological phenomena in the individual. Personality studies, history taking and the discussion of the subjects' bodily complaints and difficulties in his life situation took place in the experimental setting as part of the observations together with simultaneous recording of changes in finger temperature. Test situations were introduced which were samples of significant experiences, stresses and strains in the subject's daily existence. Thus, measurements could be made of a physiological reaction during a significant event in the subject's life. In other experiments the combined influence of emotional and physical environmental factors on the physiological function was studied by keeping the emotional setting constant and varying the temperature of the environment. Finally, the experimental findings, the data relating to the personality, history, life situation and bodily complaints of the subject were synthesized.

Experimental Conditions and Control Observations: All experiments were conducted in a semi-dark, sound-proof room maintained at constant temperature by a current of conditioned air with a replacement of 170 cu. ft. per

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min. The subject rested comfortably on a cushioned table, placed outside the direct path of the moving air currents which otherwise might have influenced the ability to maintain a high and steady finger temperature. Either the left, or both hands were placed on a pillow with the fingers close to a Hardy radiometer (12). The use of this instrument entails no inconvenience for the subject. The dorsal surface of two phalanges of three fingers, in close contact with each other, approximated the opening of the instrument which measured the radiations from a circular surface of 4 cm. in diameter. The experiments on any one individual were performed at about the same time daily (22, 9, 21). All subjects had adequate diets (24, 21, 19, 26).

Suitable recognition was given to the factor of body warmth and heat loss. All subjects during the experiments wore uniform hospital clothing and were sufficiently covered with woolen blankets to insure their warmth, thus enabling them to maintain a high skin temperature in their fingers during relaxation. Some subjects required more covering than others to achieve this end, but no more covering was given than was necessary to maintain a steady state under control conditions. The basis of the individual sensitivity to cold was not considered relevant to this discussion and was not intensively investigated.

The external conditions which affect the cooling of the hand were so controlled as to be constant during all observations and the only physical factor varied was the room temperature which was recorded from a mercury thermometer suspended in the neighborhood of the hand to be tested. In one set of experiments the room temperature was *ca.*¹ 20°C and in the other *ca.* 26°C. The

¹ *Ca.* (circa) before a temperature reading denotes the approximate temperature. The exact figures are recorded on the charts.

relative humidity of the room varied between 30–50%. Differences in this range at the room temperatures used, as well as outdoor temperatures and humidities, were found, here as elsewhere (24, 26, 1, 20, 5, 16, 27), not to be related to the data on skin temperature; they have, therefore, been omitted from the included protocols.

The skin temperature of the fingers was registered continuously, and recorded at intervals of 15 seconds to several minutes. In some experiments the temperature of the skin of both hands, the cheeks, forehead, and feet also were measured. Mouth temperatures, in most instances, were recorded at the beginning and at the end of the observations, and occasionally also the pulse rate.

In the control experiments the subject was asked in a kindly manner to attain a "state of relaxation and contentment", and many subjects fell asleep for short periods during such observations. Control periods were of two types. The first or longer, consisted of a series of recordings of the skin temperature of the fingers, made at frequent intervals during a 2 to 3 hour period of relaxation in the constant temperature room. The purpose of these observations was to familiarize the subject with the procedure and to ascertain the level of the temperature of the skin under fixed conditions. Following such periods no test situations were introduced. After stable results had been obtained (often a matter of repeated periods of observation on different days) the second type or shorter control observation was introduced. Here the procedure was the same as above except that it lasted only 45 to 60 minutes and was followed by the introduction of test situations. These test situations usually terminated within an hour, and were in turn followed by a final control period of 45

to 60 minutes during which the subject was again urged to relax.

When the subject was sufficiently clad and relaxed, the skin temperature of the fingers started high (between 31°C and 36°C), and remained at that level with minor fluctuations throughout the control period. In some ambulatory subjects on cold days 10 to 30 minutes elapsed before the temperature of the fingers reached a high level. Once this level was reached, however, it was maintained throughout the observation. If the subject was adequately clad and relaxed, the skin temperature of the fingers behaved similarly in a warm (26°C) as in a cool environment (20°C), and the season or time of day produced no constant appreciable variations in the temperature of the skin. Subjects who responded to emotional stress with major drops in skin temperature often had minor fluctuations during the control experiments. These variations which took place even during supposed "relaxation and contentment" could sometimes be correlated with swings in the affective state of the subject occurring spontaneously during the control period (15). Relaxation was sometimes best induced through the medium of mildly entertaining literature.

There was no significant change in the mouth temperature and pulse rate during the control period. The temperature of the feet followed the direction of the finger temperature whereas the forehead temperature changed but little. The skin temperature of the fingers of the two hands was almost identical.

When the subject was clad insufficiently in an environment of 20°C, the temperature of the fingers remained low or if initially warm, slowly declined and the subject complained of feeling "chilly". Although, as stated above, some subjects required more

covering than others, the behaviour of any one individual was predictable.

Methods Used to Induce Affective States Experimentally: Several procedures were used to induce affective states experimentally, but the most satisfactory was found to be a discussion dwelling on difficulties in the individual's life situation to which he reacted with signs of distressing emotion. Stenographic notes of the statements of physician and subject, including the current mood, paralleled the record of skin temperature in most experiments. For some subjects the solving of problems and the performance of tasks such as retention of digits with repetition forward and backward, definitions and etymologies of words, and the solution of puzzles were effective. For others, horrifying or otherwise moving literature was obviously distressing.

The details of the application of these methods in terms of personality features will be given in each protocol. A control period as described above preceded and followed all these interviews.

Representative protocols of eight subjects out of a total of 47 have been selected to demonstrate the main features observed. The biographic and personal data of each subject vary in nature and amount, and only that was included which was considered relevant to the associated experiments.

I. MAJOR TEMPERATURE CHANGES IN THE EXTREMITIES OF SUBJECTS UNDER EMOTIONAL STRESS

A. THE INFLUENCE OF THE DOMINANT MOOD ON THE REACTION TO IDENTICAL TEST SITUATIONS

Subject 1: K.T., a woman in her thirties, was satisfactorily occupied in a creative capacity as a physicist. She was effective, and resourceful, but she was resentful of

criticism and was disturbed by imperfections in her work. Assumption of responsibility sometimes got her into situations which were more than she felt she could handle. She then became tense and had diarrhea and cold hands. She prided herself in having a good and disciplined intellect. She valued the esteem of her associates and surrounded herself with workers with aims similar to hers. She showed poise

observation, was eager to perform well, and felt inadequate when she failed. The noises were distracting and the conversation irritated her because she could only half hear it. The moods involved in the experiment were tension, anxiety, apprehension of failure, feeling of being pushed, pleasurable excitement, irritation and frustration. The presence of the two experimenters increased the subject's need to reach her high standard of performance.

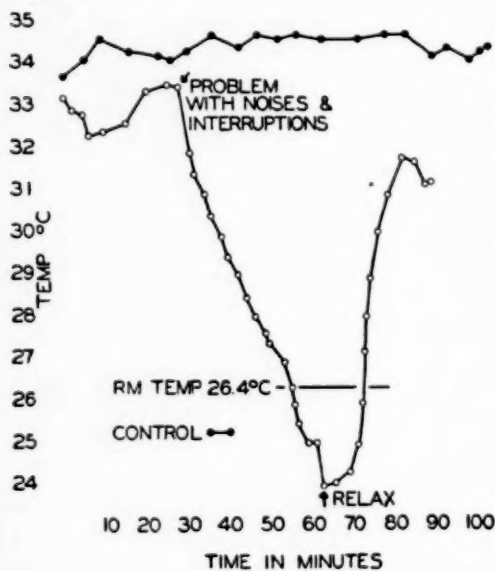


FIG. 1

in contact with people, formed intimate friendships, and won people's confidence easily. Her recreations were satisfactory. She was not excessively orderly, though efficient in her budgeting of time and money. Usually her mood was optimistic.

Subject 1. Experiment 1: 9/26/36. (See Fig. 1). At the arrow the subject was asked to retain digits and repeat them forward and backward, to give the etymologies of words, and to solve difficult puzzles. She failed in a few of the tasks and was chided for her mistakes. In addition, loud noises were made in the room, and the two experimenters conversed in barely audible tones so that the subject could hear only part of what was being said. At the second arrow the stimuli were stopped and the subject was urged to relax.

She stated that during the experiment she was interested in the results of the

Comment: The fall in skin temperature (9.5°C , 2.3°C below the room temperature) seen in this experiment was of a magnitude which was repeatedly observed in subsequent experiments. Such a drop probably represents a vasoconstriction which is almost complete. When the emotional stress is prolonged, the fingers continue to lose heat as do the limbs when their blood supply is completely cut off by a tourniquet, or when in a cat, a ligature is placed about the abdominal aorta (10). The skin temperature may then fall to that of the environment or below it if sweat is evaporating.

Subject 1. Experiment 2: (See Fig. 2). 9/28/36; 10/7/36; 10/12/36; 10/26/36. The test situation was standardized in that the subject was asked to retain and repeat the same number of digits forward and backward (12 series of 9 digits) in successive experiments conducted on different days. With each such attempt, whether with success or failure, there was a drop in the finger temperature (7.2°C , 4.4°C , 3.7°C and 3.3°C respectively).

The largest drop (7.2°C on 9/28/36) occurred under the following circumstances: the subject assumed the responsibility for the care of a depressed and agitated aunt's household. The aunt who was destitute but complained that she was being exploited, had a familiarity with the subject's temperament and the facts of the subject's life, that placed her in a position to harangue her niece upon major issues. This caused emotional havoc in the subject and created, on the one hand, a desire to

be free of her aunt, and on the other, feelings of guilt that she should want to shirk her responsibilities.

Comment: The particular personality and values of the subject were important in relation to the quality and intensity of the reaction, as were changes

It is to be noted that the progressive decrease in the fall in skin temperature (see Fig. 2) occurs on progressively later dates. It might, therefore, be inferred that familiarity with the test procedure was the sole cause of the declining skin temperature reaction. This,

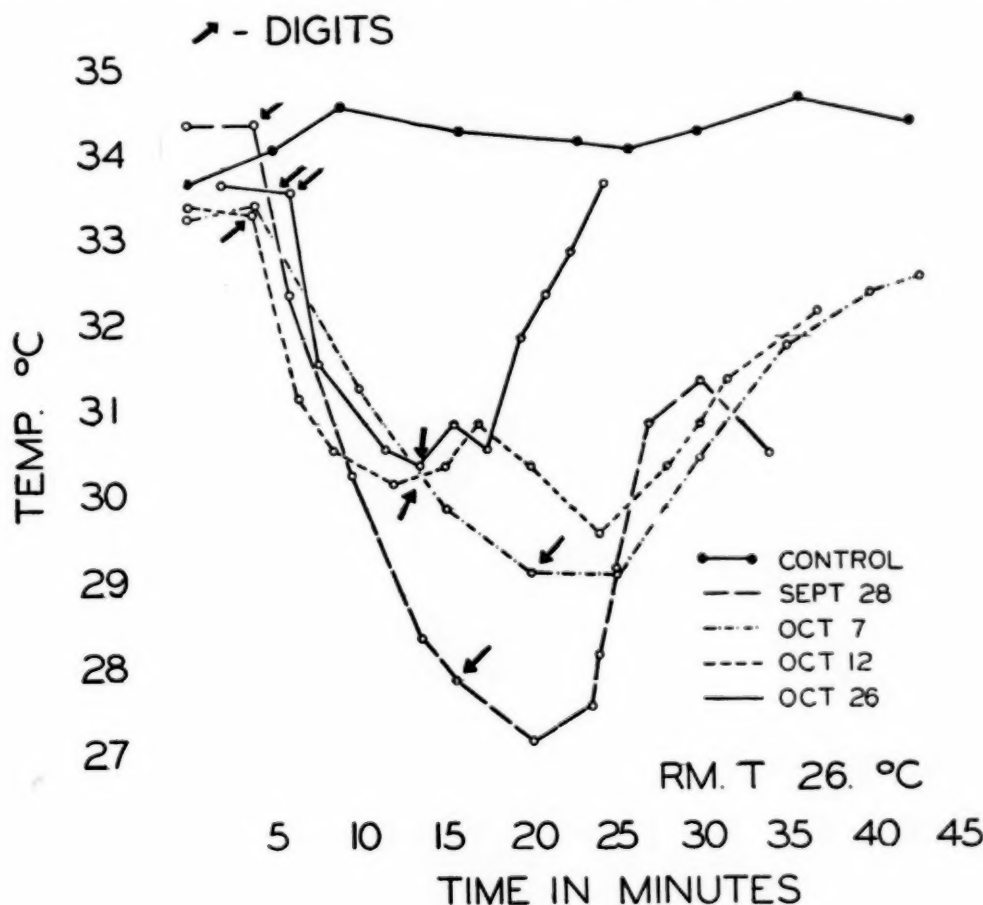


FIG. 2

in her life situation with the subsequent prevailing mood. During a period of stress and conflict (9/28/36) the identical test situation produced a fall in finger temperature which was double that occurring during a period when she felt she had her life situation well in hand. It is significant that the readily accomplished task was achieved at a greater cost under such circumstances.

however, is unlikely since the further passage of time and increasing familiarity did not prevent the following over-reaction. Some months later in the midst of a crisis precipitated by the unacceptable personal overtures of a man toward whom she felt familial responsibility, she was asked to participate in further experiments involving discussions of life situations. She was

aware of her growing fear of the test situation and on the morning scheduled for the experiment her tension rose to the point of tears and rebellion. Her hands were "icy" cold. Anticipation of the embarrassment and added burden of the test was more than she could tolerate.

Summary: An ambitious subject with rigidly high standards of performance and a tendency to assume too much responsibility was able to relax and maintained a high finger temperature under "control" conditions. She had a major drop in finger temperature (9.5°C) when flawless performance was demanded of her, under difficult circumstances (Fig. 1). Under identical test situations she had a greater fall in finger temperature on days of apprehension and insecurity arising from her difficult responsibilities than on days of self-confidence (Fig. 2). In daily life she suffered periodically from cold extremities.

B. THE EFFECT OF THE PRESENCE OF DIFFERENT OBSERVERS UPON THE LEVEL OF SKIN TEMPERATURE OF THE SAME SUBJECT

Subject 2: M.B., a shy, tense, inelastic woman in her twenties occupied as a chemist, complained of cold hands. She was capable and liked to do her work well, though she had no specific ambitions. She lacked tact, had a "stand off" attitude and was tense in her contact with patients, visitors and even with the laboratory personnel. Her work was a source of anxiety, since it dealt with intimate details of personal adjustment toward which she could not assume a detached or impersonal attitude. She demonstrated through minor outbreaks her rebellion against criticism and authority. She was appreciative of friendly gestures. It was difficult for her to make new friends, though she had several friendships of long standing. She usually labored under financial difficulties. When she earned money she had trouble in

budgeting it. She lived at home and had constant difficulties with her parents, feeling resentful toward them, and desiring emancipation; thus, much of the time she was unhappy. Nevertheless, she was able to enjoy recreations. During the course of the study she made many personal and domestic adjustments. She no longer lived at home, became far more relaxed and expressive, and attained greater satisfaction in her work. Experiments 3 and 4 below, were conducted during this latter period.

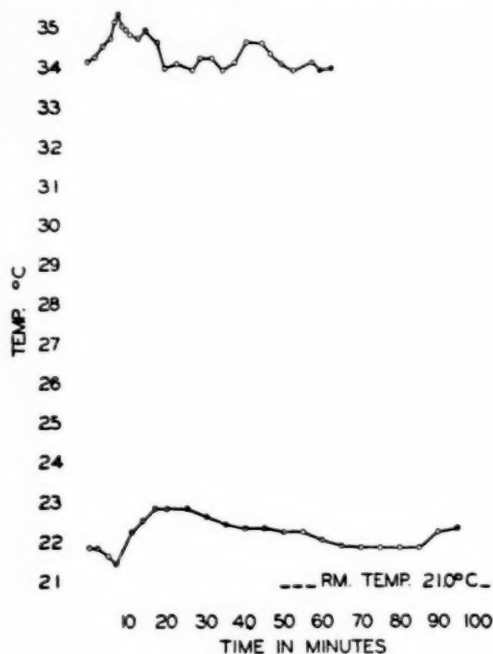


FIG. 3

Subject 2. Experiments 1 and 2: (See Fig. 3). The upper circled line (1/28/37) illustrates the level of skin temperature (*ca.* 35°C) of the fingers under "control" conditions with Observer B, a co-worker and friend, with whom she could always discuss personal matters freely. The lower circled line (1/18/37) illustrates the level of skin temperature (*ca.* 22°C) maintained with Observer A in whose presence the subject was not able to relax, uneasy lest she be asked to discuss personal problems (tension, fear, embarrassment, disapproval, and resentment). (Difference of *ca.* 13.0°C). There was no conversation in either experiment.

Subject 2. Experiment 3: (See Fig. 4). The circled line (5/3/37) illustrates the skin temperature of the fingers in the presence of Observer A after personal adjustments were made that permitted partial relaxation. Although relaxation was incomplete (mild apprehension), the subject's skin temperature of the fingers in a very warm environment (24°C) approached a high level relatively quickly. (Contrast with Fig. 5.) The arrows indicate the start and end of an interview which experimentally induced embarrassment, feelings of inadequacy, resentment, tension, fear, and rebelliousness through a discussion of the subject's relations to her parents. There was a fall of 9.8°C in skin temperature despite overheated environment (28°C).



FIG. 4

Subject 2. Experiment 4: (See Fig. 5). 5/11/37. The temperature of the experimental room was 21.0°C and the experiment was conducted by Observer A. The subject, as stated above, had by this time made a better adjustment to her home and work situation. She had grown less sensitive and apprehensive to the presence of Observer A, yet in this cool environment it took over an hour for the skin temperature of her fingers to reach a high level (ca. 34°C). Contrast this experiment with experiments 1 and 3.

Comment: Experiments 3 and 4, con-

ducted after the subject had made a better adjustment to her work and to her home life, illustrate the combined influence of emotional and physical environmental factors on the circulation of the fingers. During this period (ex-

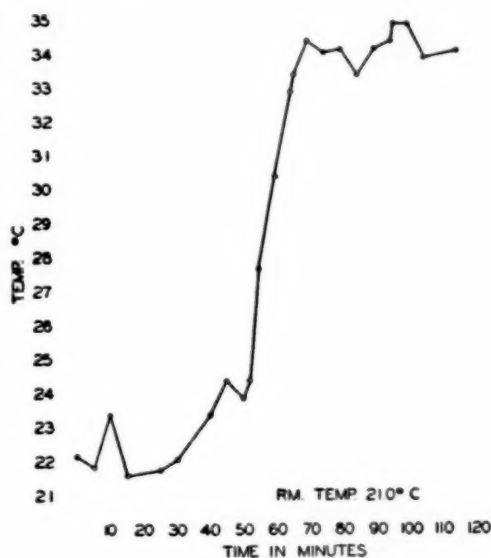


FIG. 5

periment 3) the subject was capable of partial relaxation in the presence of Observer A. In an overheated room the temperature of her fingers readily reached a high level. When, however, the emotional stress became intensified (discussion of family situation) a rapid fall (9.8°C) occurred. In a cool environment (21°C) the finger temperature reached a high level very gradually (experiment 3). It appears then that the moderate vasoconstrictive influence of slight uneasiness and incomplete relaxation was counteracted by the vasodilating effect of the warm environment. On the other hand, the vasoconstrictive effect of cold air combined with the vasoconstrictive effect of stress. Such interplay between affective and physical environmental influence on the vasomotor phenomena of the extremities will be further illus-

trated on a patient with Raynaud's Syndrome (see page 287).

Apropos of the low finger temperature maintained in experiment 1 the following considerations are relevant. The magnitude of the fall in the skin temperature of the fingers is in part determined by the level from which the fall begins. Thus, from an initial level of 34°C skin temperature, a given test situation produced a drop far greater (ca. 10°C) than did the same situation from an initial level of 23°C (ca. 2°C). This was demonstrated in 9 experiments (subject 2 and others) in which exception was made to the previously described experimental procedure concerning the control level of the skin (30°C to 31°C) from which experiments were begun. Such differences in magnitude are to be anticipated since it is obvious that the constrictive ability of dilated blood vessels is far greater than that of partially or almost completely constricted vessels.

Further, it is to be noted in connection with these observations that experimentally induced tension, embarrassment, and resentment caused a fall and never a rise in finger temperature. This occurred whether emotional stress was induced at high finger temperature (state of relaxation) or at low finger temperature (inability to relax).

Summary: A shy continuously tense woman was not able to relax and had a low finger temperature (22°C) even under "control" conditions in the presence of observer A (Fig. 3). In the presence of observer B she could relax, with high finger temperature (ca. 35°C) (Fig. 3). After better adjustment, she could partly relax and her finger temperature reached a high level quickly in the presence of observer A in an overheated environment (28°C) (Fig. 4), but only very gradually in a cool environment (ca. 20°C) (Fig. 5). In daily life she suffered continuously from cold hands.

C. TEST SITUATIONS DESIGNED TO INFLUENCE SKIN TEMPERATURE MUST HAVE SIGNIFICANCE FOR THE INDIVIDUAL

Subject 3: Q.T., a tense, shy, and inelastic high school girl in her late teens was slow to adjust herself to her maturing drives and adult experiences. She had strong feelings of loyalty toward family and authority. When she was recovering from an appendectomy at New York Hospital it was noticed that her hands usually looked bluish and were moist and cold. She stated that her hands had been that way "since childhood", but she did not complain about them. She was the youngest of 4 siblings, from her father's second marriage. Her mother preferred her above the other children. She got along well with her 3 brothers and with her mother, but not with her father, who often "got angry and did not speak for days". She stated that at eight years of age she had engaged in mutual masturbation with her cousin; they were discovered by the subject's aunt and were roundly scolded. This severely shocked the child and she had never masturbated since. At the age of 13 she obtained information about sexual intercourse and the birth process from a friend of her own age. She found it all very shocking. She disapproved of extra-marital sexual relationships and had had none. She was only moderately ambitious, and no rivalry existed between her friends and herself. She did not approve of showing strong emotions openly, but got angry very easily "like her father", and then felt ashamed of it. She tended to minimize her difficulties and tried to present an unruffled surface. Her outlook was usually cheerful.

Subject 3. Experiment 1: (see Fig. 6). 10/3/36. After a "control" period lasting 30 minutes (finger temperature ca. 32.5°C), she was given a pamphlet to read, entitled "Sudden Death" (7), which presents harrowing details of the results of motor accidents. However, there was a drop in the finger temperature of only 1.8°C in 20 minutes (this period is not shown in the figure). She was then asked to read an address by President Roosevelt on the occasion of the dedication of a newly built medical center. During the reading there

was a drop in the temperature of her fingers of 5.3°C . The subject stated that the pamphlet "Sudden Death" did not excite her; it was "newspaper stuff"; Roosevelt's speech did. She said, "Two of my brothers are working on a government project, being supported by the government. They will vote against Roosevelt in the coming election. That's not fair to him. We have had many quarrels about it at

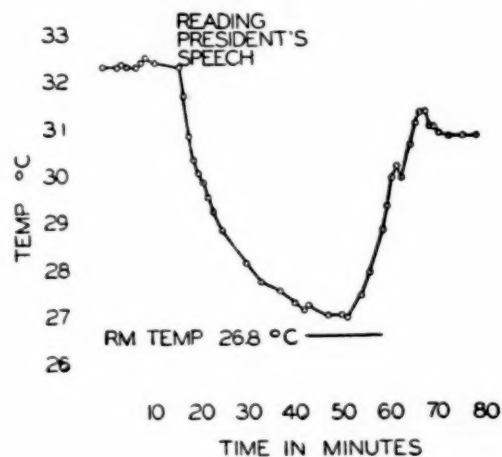


FIG. 6

home". During the reading she experienced anxiety, insecurity, anger and resentment.

Comment: The experiment illustrated the individualized significance of test situations. A commonly distressing stimulus (description of automobile accidents) did not disturb the subject because of contemptuous attitude toward the presentation. On the other hand, an apparently bland topic (reading the impersonal remarks by the President) produce a large drop in finger temperature (5.3°C) because it reminded her of strife and disharmony in her home life, a matter of major importance to this insecure girl.

Subject 3. Experiment 2: (see Fig. 7). 10/5/36. At the arrow an interview was begun which dwelt upon the above-mentioned episode of mutual masturbation, with the subject's cousin (apprehension, guilt, feeling of inadequacy, and embarrassment). The temperature of the subject's fingers dropped 8.2°C .

Comment: Because of the subject's need of approval, her inelasticity, her lack of experience, and rigid moral

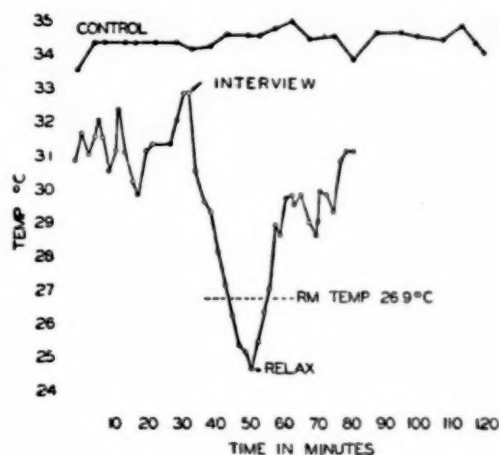


FIG. 7

attitudes the discussion of an early sex incident resulted in an untoward reaction and a major fall in finger temperature (8.2°C). The irregularity of the preceding control period may result from the subject's inability to relax (apprehension) because of anticipation of the subsequent discussion.

Summary: An insecure, tense girl, disapproving of a show of emotion, could relax with a high finger temperature (*ca.* 33°C) under "control" conditions. She had major falls in finger temperature (8.2°C and 5.3°C) if shame and guilt, or anger and fear of disapproval were aroused in her in test situations of personal significance (Figs. 6 and 7). In daily life she showed continuously cold extremities, but did not complain.

D. PROGRESSIVE INCREASE IN THE FALL OF FINGER TEMPERATURE DURING REPEATED DISCUSSION OF LIFE SITUATIONS IN A WOMAN WITH GROWING TENSION AND DESPAIR

Subject 4: S.M., a white woman in her fifties with 5 children, with a longing for happy married life and with intellectual and social aspirations, had been married for

25 years to a man whom she considered "lacking in finer qualities". With cessation of menstruation she had complaints of headache, dizziness, and hot flushes, but not of cold hands. Her blood pressure was approximately 200/100. Her married life had been repellent and a constant frustration. She had desired for many years to leave her husband, but with the onset of

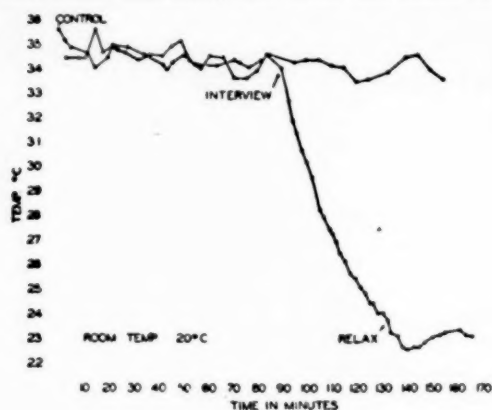


FIG. 8

the menopause hope that she might ever be free of him had at last died. Since the onset of her menopause she had tried to reject her husband's advances completely, which led to noisy quarrels. He threatened to kill her if she left him. She was often in low spirits and wept. She was capable of deep emotional attachment, which was centered about her children. She had strong feelings of responsibility and was conscientious but not over-meticulous in managing her household. She worked regularly in her husband's upholstery shop. She disapproved of showing her emotions, particularly anger, but she could not control herself during quarrels with her husband. She was reluctant to complain about her health.

Comment: During the period of observation under glandular therapy she became free of her symptoms of headache, dizziness and hot flushes, but despite this improvement in her symptoms, discussion of her difficulties produced increasingly larger drops in skin temperature during each of four ex-

perimental periods. Thus, the temperature drop in the earlier experiment was 8°C as compared with 11.5°C in the later one. Repeated interviews disturbed the patient's resignation and she stated that her feeling of hopelessness and inability to cope with her situation increased. She became increasingly tense and finally begged the experimenter to discontinue the discussions. The finger temperature curve of the last observation is shown on Fig. 8.

Subject 4. Experiment 1: (see Fig. 8). 3/8/37. At the arrow a discussion was started about the subject's marital difficulties; this gave rise to frustration, rage, resentment, feelings of helplessness, hopelessness, despair, and depression. There was a drop in the temperature of the hand of 11.5°C. When asked, the subject said that her hands felt slightly cold. She also complained of a cramplike sensation in the lower abdomen. After one-half hour, the conversation was ended, and the subject was urged to relax, but she stated, "I am not able to calm down". The temperature of her fingers stayed at a low level during the rest of the experimental period.

Summary: An "aspiring", unhappy, but partly resigned woman could relax and maintain a high finger temperature (ca. 34°C) under "control" conditions. In successive experiments she had increasingly larger drops in finger temperature (maximum 11.5°C) because repeated discussion of her home situation disturbed her resignation and intensified her despair (Fig. 8). In daily life she usually had cold hands, but did not complain.

E. FURTHER VARIETY OF INDUCED EMOTIONAL STATES ASSOCIATED WITH MAJOR DROPS IN THE TEMPERATURE OF THE EXTREMITIES

Subject 5: L.K., a high school girl in her late teens complained of cold hands. She

was an only child whose parents separated when she was one year old. She lived with her mother and occasionally with her grandmother. At the age of 15 the subject met her father again (3 years ago) when she spent a summer at his house. She said that he had "treated her like a housemaid", and had called her promiscuous. She had wanted to run away. Finally, she returned to her mother, and was living with the latter at the time of the observations. She had an unfortunate series of sex episodes, beginning at the age of 12 when she masturbated with a boy of 7. At 14 she had intercourse with a boy of 19 and contracted gonorrhea. The ensuing complications kept her out of school for a year and for the last three years she had had periodic low grade fever, which initiated her anxiety that she would become an invalid. Numerous sex episodes continued and the subject was constantly fearsome lest she become pregnant, infect her partners, or that they should learn that she was promiscuous. She had feelings of guilt and of worthlessness. She was an average pupil with irregular achievements. She was eager to excel, but was constantly afraid of failure. She felt distressed when surpassed and was convinced that she was not intelligent, comparing herself unfavorably with friends and with her mother who had had a successful academic career. She was comely, yet convinced that she was unattractive and that she had "pop eyes". She was sensitive to disapproval, and desired praise and attention. She had many acquaintances but did not form close friendships. She was attached to her mother, whom she considered a "companion", but she was often on bad terms with her because of criticisms and disagreements on general questions. She would then not speak to her mother for weeks and felt bitter and helpless because she was dependent on her for support. She was impulsive and headstrong. She had diffuse interests in social and scientific problems and was irregularly engaged in radical political activities. Her conversation was lively but flighty. Her moods changed quickly, and she was easily angered.

a. Major Temperature Changes Associated with Tension, Guilt, Apprehension, Anger and Feeling of Helplessness

Subject 5. Experiment 1: (see Fig. 9). 2/20/37. At the arrow she was asked to retain and repeat a series of digits forward and backward. The skin temperature of her fingers dropped 4.8°C in 12 minutes. The

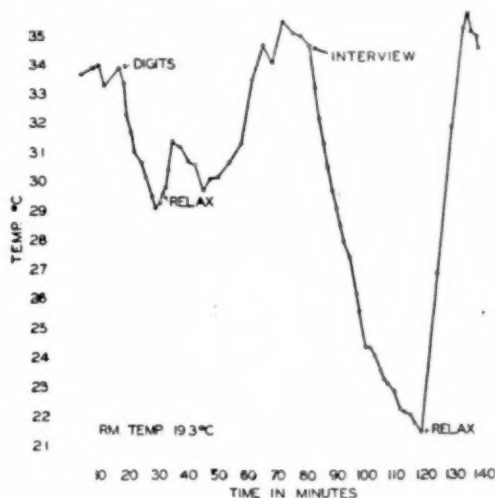


FIG. 9

task was then terminated. After some fluctuations the finger temperature of the subject's fingers again reached a high level. The experimenter then engaged the subject in a conversation about her mother with whom she was on bad terms at the time. The skin temperature of the fingers dropped 13.2°C. The conversation was terminated and she was then able to relax. The skin temperature of the fingers returned to *ca.* 35°C. The subject stated that during the repetition of digits she was eager to perform well. She considered the procedure a test of her intelligence and was disturbed over mistakes. She stated that her anger and feelings of inadequacy and of helplessness were more intense while retaining and repeating digits than when she talked to the experimenter about her parents.

Comment: The subject showed a drop in the skin temperature of her fingers

at 13.2°C during affective states of a complex nature (tension, anxiety, guilt, feeling of helplessness, apprehension). In comparison with the digits test the fall in temperature when the patient talked of her parents was equally rapid and better sustained. She was then probably not fully aware of the intensity of her emotions.

b. Major Temperature Changes Associated with Pleasurable Excitement, Involving Tension, Guilt and Apprehension

Subject 5. Experiment 2: (see Fig. 10). 2/27/37. The control period was characterized by fluctuations in the finger temperature associated with spontaneously oc-

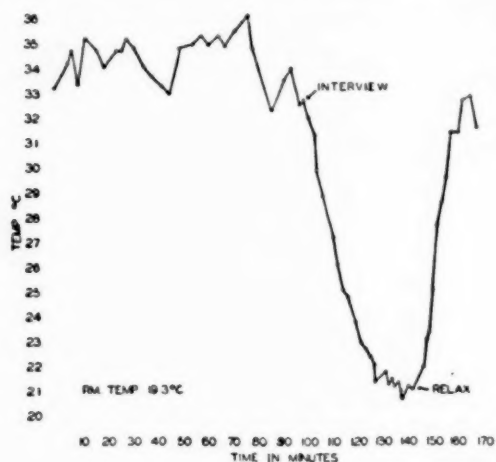


FIG. 10

curing tension, boredom and apprehension. At the arrow the subject began to talk of the pleasant experiences of the past week, mentioning her visits to the theater and to nightclubs. During the conversation, the temperature of the fingers dropped 12°C . When the fingers were coldest, the pulse rate was 56. The temperature of the forehead was 34.2°C at the beginning of the conversation and 35.5°C at the end. That of the cheeks was 34.5°C at the beginning and 35.3°C at the end. At the second arrow the subject was urged to relax. At the end of the observation, the temperature of the forehead was 34.9°C and that of the cheeks 35.4°C . The subject felt

pleasurable excitement during the conversation. She stated after the experiment that her menstrual period was delayed and she feared that she might be pregnant, but this thought did not enter her mind during the experiment.

Comment: Although a fall in finger temperature conceivably may accompany pleasure, the affect here was probably more complex and included elements of tension, anticipation and apprehension. The thought of her possible pregnancy may have influenced her mood, and memories of her recent activities may have aroused feelings of guilt and apprehension. Furthermore, she had previously stated that she was "never able to enjoy herself fully". Apparently, enjoyment for her entailed conflict. Here, as in other experiments, a slight increase in forehead and cheek temperature was observed to accompany major drops in the skin temperature of the fingers(9a).

c. Major Temperature Changes Associated with Effects Resulting from Discussion of Interesting "Impersonal" Topics

Subject 5. Experiment 3: (see Fig. 11). 3/13/37. During part of the control period, the subject slept spontaneously. After she was awakened, at the arrow, a conversa-



FIG. 11

tion ensued about school, hypnosis and vivisection. She was asked to sing "revolutionary" songs which she said she enjoyed. She was lively and interested. The skin temperature of her fingers dropped 11.2°C , and remained at this low level while her singing continued.

Comment: The relation of "awareness" and "insight" to the fall in finger temperature under stress requires consideration. It was readily ascertained in Subject 5, and also observed in others, that there was no close relation between the magnitude of the fall in skin temperature and the patient's awareness of the nature and intensity of the mood. Subjects, fully aware not only of the varieties and components of the mood but also of its basis, had major falls. This was true in sophisticated persons of experience in verbalization and understanding of personal problems. On the other hand, unawareness of components of a mood or its intensity, either because of lack of experience, or because of an attitude which repressed feeling, was also accompanied by major falls in the skin temperature of the fingers. In short, "awareness" or "unawareness" did not determine the magnitude of the bodily reaction.

In general, when emotional stress was relieved the finger temperature rose to a high average level. Such relief was afforded chiefly by reassurance and persuasion. It is conceded that sometimes emotional stress may be relieved through the subject's recognition of the nature of his attitudes. Under these special circumstances the change in the bodily state would follow the complicated emotional changes that accompany "insight".

Discussion of interesting "impersonal" topics and singing were associated with major changes in the skin temperature of Subject 5. The subject stated that her extremities were usually cold, and felt warm only when she was

relaxed in the constant temperature room. This may be taken as a further evidence that the subject reacted to many situations in her life with excessive and complex feeling. She could be truly "relaxed and comfortable" only in such circumstances as obtained during the control experiments. Again, as indicated above, her pervasive underlying feelings of guilt, unacceptability, and apprehension colored her reaction to all situations including those ostensibly pleasurable.

Summary: A girl with feelings of worthlessness and guilt and "inability to enjoy anything fully" was able to relax and had a high (*ca.* 34°C) but fluctuating finger temperature under "control" conditions. She had major falls (maximum 13.2°C) in finger temperature during discussions of difficult home situations (Fig. 9), of pleasurable experiences (Fig. 10), and of "impersonal" topics of special interest to her (Fig. 11) without being fully aware of her distressing emotions. In daily life she suffered from continuously cold extremities.

II. SUBJECTS WITH MINOR TEMPERATURE CHANGES IN THE EXTREMITIES DURING STRESS

There was a group of subjects, who, despite avowedly intense emotional disturbance, had but minor changes in skin temperature. Some of these individuals suggested through gesture and word that they were over-reacting with superficial or shallow feelings to the test situation. Others with similar minor falls in finger temperature stated without histrionics that they were deeply disturbed by the test situation and their behavior impressed the examiners that their statements were valid. It is possible, to be sure, that the test situations did not really move the individuals of the latter group, and that the examiners were mistaken as to the

profundity of the subjects' disturbance; but all individuals may not have correspondingly great changes in the skin temperature of the extremities with emotional stress and may perhaps have more significant change in other non-recorded bodily functions. In this small series the male subjects usually had lesser falls in skin temperature than did the females, although major falls (13°C) among males, and minor falls among females were observed. Hence the lack of considerable drops in the skin temperature of the fingers of the two male subjects presented below were not determined by sex alone.

A. MINOR SKIN TEMPERATURE CHANGES UNDER APPARENTLY INTENSE EMOTIONAL STRESS

Subject 6: Z.K., an artist in his thirties had given up the pursuit of valued artistic aims because of financial hardships but was

Subject 6. Experiment 1: (See Fig. 12). The empty circled line (12/14/36) illustrates a fall (2.4°C) in skin temperature of the fingers accompanying experimentally induced tension, guilt, feelings of inadequacy and helplessness (at the arrow) through a discussion of the subject's extramarital relations. The solid circled line (12/21/36) illustrates a fall (2.4°C) accompanying experimentally induced embarrassment and feelings of inadequacy through retention and repetition of digits and word definitions (at the arrow) in the presence of persons unfamiliar to the subject. In connection with the conversation about his marriage he remarked, "There is no subject that stirs me so deeply. When the difficulties in my marriage arose I had the feeling that I was wrecking my life and the happiness of two other people, but I felt that I was drifting helplessly into the situation".

Further evidence that the subject was reacting profoundly to the threatening separation from his wife came 6 months

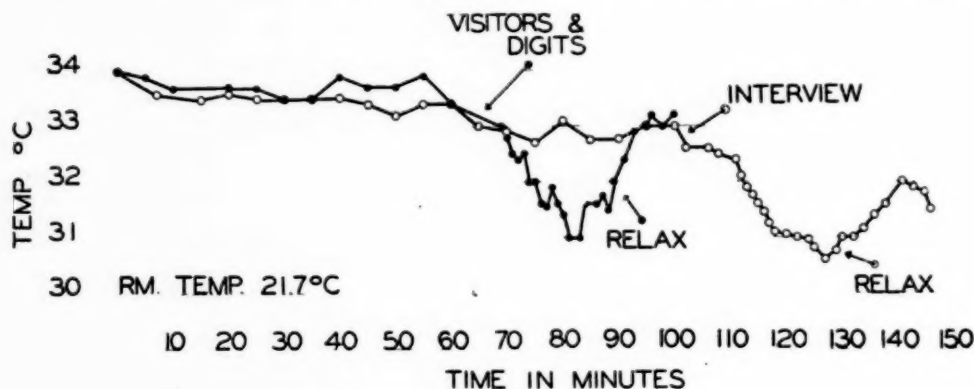


FIG. 12

also unsuccessful in "advertising" art. He felt self-contempt over his failure. He said he loved his wife, needed her approval and at times he was financially dependent on her; yet, he became repeatedly entangled in extramarital relations which aroused his wife's jealousy. He then felt guilty, perplexed, and helpless. In his occupation, as well as in his relation with his wife, he lacked clarity of purpose, persistence, or the ability to effect a consistent and successful compromise. He suffered from gastric ulcer but not from cold extremities.

later when she left him. The subject said, "I descended into the gutter. I pick up women in saloons and live with them on their support and I borrow quarters from my friends. I do it because the gutter has its own means of support and I want to see whether I am man enough to stand it".

Summary: A man with conflicts about his career and his wife showed a minor drop in finger temperature (2.4°C) under apparently intense emotional stress (Fig. 12). He suffered from

gastric ulcer, but not with cold extremities.

B. MINOR CHANGES IN FINGER TEMPERATURE DURING APPARENTLY INTENSE EMOTIONAL STRESS IN A SUBJECT WITH GRAVES' DISEASE

Subject 7: A.G., a worrisome, inflammable Italian individual in his fifties, developed Graves' Syndrome after an inci-

His mother died when he was 35 years old, and soon after, he married an older woman with some property. Difficulties arose only on questions concerning the management of her estate.

His Graves' Syndrome started during the following circumstances. He discharged a helper from the bathing pavilion owned by his wife and a few days later he found his "nickname" painted on the walls, and some articles stolen from his store. The subject

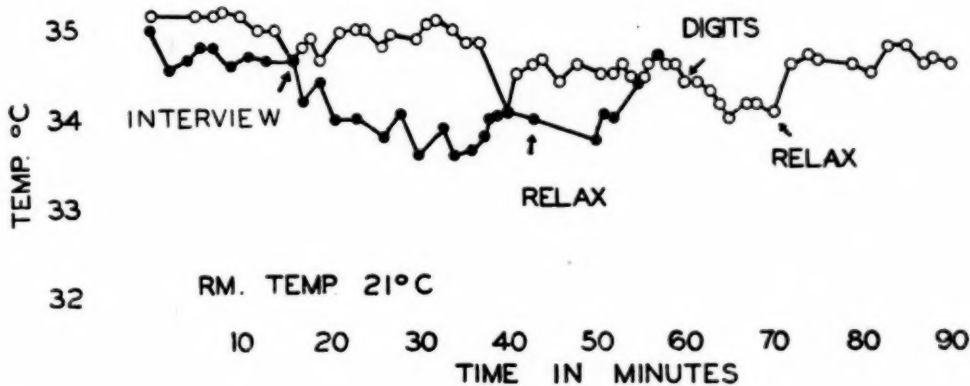


FIG. 13

dent which threw him into a murderous rage for which he could find no suitable outlet. He complained of cold hands until, but not after, the onset of his Graves' Syndrome. This subject was admitted (1/20/37) to the New York Hospital because of palpitation, sweating, weight loss and irritability. His basal metabolic rate on admission was +12—5 days later it was +28.

The subject was a responsible individual. He over-reacted to issues of "fairness", and "nothing hurt him more than injustice". His anger was easily aroused, and he freely expressed it. He had done well in school, although he was often a truant. For this he was punished by his father who was a strict disciplinarian. From the age of 15 he had worked steadily at various occupations. After his father's death he became the sole support of the family. He started to masturbate regularly at the age of 15 years and continued to do so, without conflict until the age of 22 years, when he entered into sex relations with a girl. The relationship with this girl continued for 7 years, and then dissolved, since he would not marry because of his dependent mother.

was outraged and frustrated because he could do nothing about the insult and theft, although he was convinced that the man he discharged was guilty. Soon thereafter he became tense and restless and rapidly lost weight.

Subject 7. Experiment 1: (see Fig. 13). The solid circled line (1/23/37) illustrates the effects of experimentally induced anger, frustration and humiliation through discussion of an insult which he could not avenge, and following which symptoms of Graves' Disease had appeared. During the interview he said he relived in his memory the incident discussed and was aware of considerable anger and of feeling powerless. The empty circled line (1/20/37) illustrates the effect of induced tension and anxiety by asking him to retain and repeat digits. The arrows indicate the start and end of the respective procedures.

Comment: This patient showed the least drop in the finger temperature of any subject observed in this series

under presumably comparable stress. He had stopped complaining of cold extremities about the time of onset of his Graves' disease. It may be that Graves' Syndrome interferes with major drops in the temperature of the fingers during stress.

Summary: A worrisome, irascible man with a marked "sense of fairness" developed Graves' Syndrome following an insult for which he could find no redress. He had a slight fall in finger temperature (1°C) under induced emotional stress (Fig. 13). He suffered from cold hands up to but not after the onset of his Graves' Syndrome.

III. MAJOR TEMPERATURE CHANGES IN THE EXTREMITIES UNDER EMOTIONAL STRESS IN PATIENTS WITH RAYNAUD'S SYNDROME

The interrelation between reactions to life situations and attacks of pain in patients with Raynaud's Syndrome has frequently been observed. The correlation is suggested by Raynaud's own protocol of a patient presenting the phenomena which bear his name (11). *Case 5.* About a month after the death of her mother, whom she had nursed and whose death she had witnessed, the patient's fingers often became discolored and painful. Such discomfort was precipitated by cold and would disappear in the warmth. Later, the feet became affected and "cyanosis" appeared without "obvious cause", even in the midst of an examination by Raynaud. It is apparent that the death of her mother with its implied destitution and distress was a factor in the onset of the disease and later, apprehensiveness in the presence of Professor Raynaud could precipitate attacks.

Fremont-Smith and J. C. White (6) observed a young woman with Raynaud's Syndrome, who had been subjected to right cervical sympathectomy. On one occasion while the finger tem-

perature of the middle finger and the capillary circulation were being observed bilaterally, two physicians, unfamiliar to the patient, entered the examining room. Suddenly, the blood flow in the nail bed of the middle finger on the unoperated side came to a complete standstill, and the temperature of the tip of the finger fell slightly. The patient was known to develop blanching of her hand when she met strangers.

In this investigation five patients with Raynaud's Syndrome were studied. The following patient is representative and her protocol is therefore presented.

Subject 8: M.R., a timid, ineffectual woman in her thirties, complained of having had, for 5 years, attacks of pain and cyanosis in her fingers, extending at times up to the second and third phalanges, particularly of the middle and index fingers. The nails were brittle and there was thickening and fissuring of the finger tips. The attacks recurred periodically, and recently she recognized that fear also initiated attacks.

She was the third of eight siblings. She had been a quiet, timid child, devoted to both her parents, though particularly sympathetic and helpful to her mother who was blind when the patient was born. After finishing elementary school, she worked efficiently as an operator on children's dresses. She also danced well. She was poorly informed about menstruation and was very much frightened at its first occurrence. She had not masturbated and had no sex enlightenment before her marriage at the age of 16. Her first husband mistreated and beat her. The patient bore a strong resentment against him, and on one occasion drank iodine with suicidal intentions. She attributed a tubal pregnancy which occurred not long after the marriage to having been kicked in the abdomen by her husband. She divorced this man after 5 years, resumed her work, and performed as a professional dancer. From this marriage she had one child living.

She married for the second time at the age of 22 years and for 4 years was happy

with her second husband. During her third pregnancy (2nd in 2nd marriage) her husband began to give her less money for the household. The subject then feared that her second husband was about to mistreat her as had her first. She was worried and enraged. It was at this time that she had the first painful attacks in her fingers, which were more frequent and more severe during exposure to cold. She became sexually frigid and refused intercourse. Her husband left her three months after the birth of the child. The patient became "hysterical" and was hospitalized for a few days. A reconciliation with her husband was affected about 6 months later; she became pregnant again and gave birth to a fourth child. The difficulties with her husband recurred and once more he deserted her. She rejected his later attempts at reconciliation for fear that difficulties might start anew, that she would have to submit to intercourse, and that she might become pregnant again. Further, her oldest daughter (from the first marriage) got on badly with her stepfather. The subject was living in very poor circumstances because of inadequate and irregular support by her husbands. She often lived in cold flats in the winter, at times hardly having enough money for fuel. She earnestly wanted to take good care of her children and was ashamed of her frequent displays of anger toward them. She had always been a cheerful person and retained this attitude in spite of her hardships. She never asked her friends for help but accepted it when it was offered.

The experiments on this patient were conducted at 26°C and at 20°C as were those on other subjects. They differed only in that in two experiments on this patient at the lower temperature (*ca.* 20°C) the additional factor of "cooling off" through inadequate clothing was introduced. The subject had shown in control experiments, *i.e.*, when adequately covered and relaxed that she was able to maintain the temperature of her fingers at 32°C to 33°C for 3 hours in environmental temperatures of both 20°C and 26°C.

A. INTERPLAY BETWEEN AFFECTIVE AND PHYSICAL ENVIRONMENTAL INFLUENCES

Subject 8. Experiment 1: (see Fig. 14). 10/24/36. The temperature of the experimental room was 26.4°C. Empty circled line: At the arrow, discussion was started about the patient's domestic difficulties. This induced tension, fear, anxiety, resentment, feelings of helplessness, frustration,

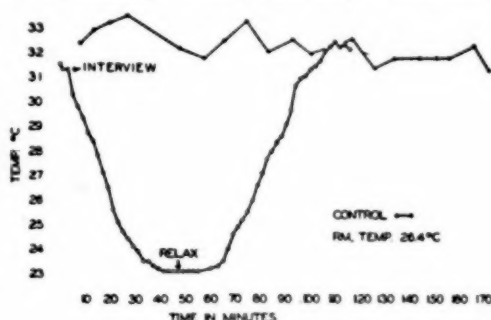


FIG. 14

and guilt. The skin temperature dropped 8.2°C. At the same time she felt pressure and pain across the temples, "was restless with headache", had a "cold sweat", a "sinking sensation in her abdomen", and a "bearing down pain" in the pelvic region, with precordial pain, palpitation, and shortness of breath. There was no cyanosis and pain in the fingers.

B. EFFECTS OBSERVED IN A COOLER ENVIRONMENT—REENFORCEMENT

Subject 8. Experiment 2: (see Fig. 15). The empty circled line (5/17/37) illustrates a fall of 13.2°C in the skin temperature of the fingers accompanying experimentally induced anger, rage, resentment (discussion of subject's difficulties with her husbands), affection and guilt (discussion about her mother), resentment, anxiety, and guilt (discussion about her children). She complained of tingling and pain in her fingers when the skin temperature was 21.2°C. The solid circled line illustrates a control experiment during which there was no discussion. The contrast between the two lines is especially dramatic since both start at the same temperature (27.3°C) and reach *ca* 33°C with relaxation.

In the next experiment the temperature of the environmental room was

again 20.5°C , but in contrast the subject was now provided with clothing known by trial to be just less than that necessary for the maintenance of a steady high skin temperature of the fingers. Under these circumstances in

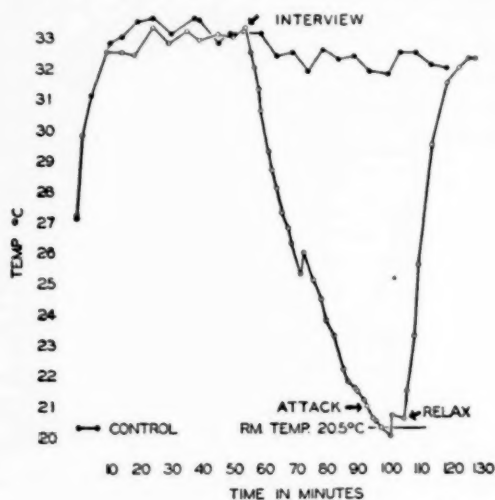


FIG. 15

control experiments without induced tension the skin temperature was unsteady and fell gradually in seesaw fashion as low as 25°C , but no pain or cyanosis occurred. Under induced stress the following changes took place:

Subject 8. Experiment 3: (See Fig. 16). The circled line (5/20/37) illustrates a fall in skin temperature of the fingers resulting in severe cyanosis and pain, associated with a combination of cooling off through inadequate body covering and experimentally induced anxiety, apprehension, anger, and grief. Between arrows A and B cooling off occurred (4.4°C). At B a transient halt in the drop in skin temperature occurred, and at C was begun a discussion of the subject's bodily illness and financial distress. The skin temperature then fell rapidly and when it reached 22°C (arrow D) the fingers became deeply cyanosed and she complained bitterly of pain. The discussion was terminated when the skin temperature of her fingers fell to 19.7°C . The subject was then urged to relax, and the skin temperature rose rapidly and the attack was terminated.

The maximum fall in skin temperature was 13.5°C .

Comment: A combination of "cooling off" through inadequate clothing and low environmental temperature with a falling skin temperature through induced stress, produced the most disturbing symptoms. It is likely that this combination closely simulates the non-laboratory situations occurring in daily life.

These experiments demonstrate the important rôle of emotions in the precipitation of pain in this patient. However, it is clear that under the experimental circumstances environmental temperature of 20°C alone, and emotional stress alone at a room temperature of 26°C , were not sufficient to precipitate attacks of pain. When the room temperature was lowered to 5°C , for example, temperature alone precipitated pain. Also, at an environmental temperature of 20°C , emotional stress readily produced pain. In short, at moderately cool temperatures (ca. 20°C) the factor of emotional stress is

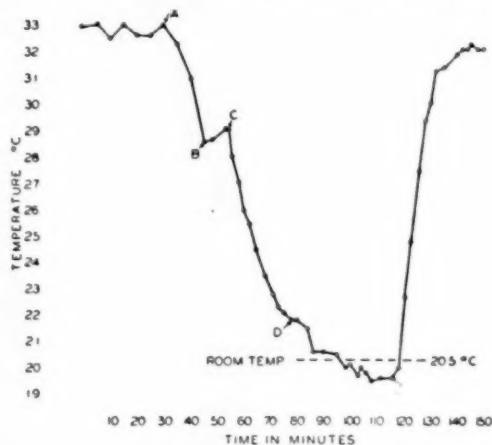


FIG. 16

of first rate significance in the precipitation of attacks.

As was shown with subject 2, in experiments 3 and 4, the affective and the physical environmental influences on the circulation of the extremities

may counteract or reinforce each other. The interplay of these two factors determines the amount of pain or incapacity the patient suffers.

The skin temperature of the fingers in a patient with Raynaud's Syndrome is in general related to the attacks of pain and cyanosis, but in no sense is there a complete correlation between skin temperature (as determined by the radiometer) and the blood flow in the skin. The radiometer measures heat radiation from the fingers, which is an expression not only of the evaporation and of the blood flow in the skin directly under the instrument, but also of the blood flow in the adjacent deeper structures. Furthermore, the difference between blood flow so low as to produce pain may be so minute in terms of cubic centimeters of blood per minute that it could easily fail to be detected by the radiometer.

There was no absolute temperature of the skin of the fingers at which pain occurred in the patient under discussion. Sometimes she complained of pain when the finger temperature was 22°C and at other times lower temperatures were necessary.

Essentially similar effects of stress were observed in the four other patients with Raynaud's Syndrome and a correlation of the complaints was found in all four.

C. THE EFFECT OF SYMPATHECTOMY

Subject 8: About a month after the above experiment a sympathectomy was performed on this patient by Dr. Bronson S. Ray (July 2, 1937). On the right side the thoracic sympathetic trunk was transected below the 3rd ganglion; the second and third thoracic white and grey rami were cut, leaving the first thoracic sympathetic intact. Following the operation experiments similar to the above were repeated.

Subject 8. Experiment 4: (see Fig. 17). The two lines (7/20/37) illustrate the dif-

ference in the skin temperature of the fingers on the sympathectomized right side (empty circled line) and the intact left side under "control" conditions. When the patient was relaxed and adequately covered the skin temperature of the fingers on the intact side was higher. The skin temperature on the sympathectomized side approached that of the intact with continued relaxation.

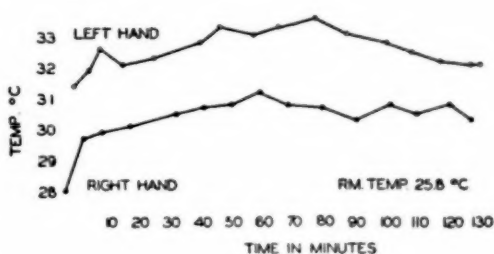


FIG. 17

Subject 8. Experiment 5: (see Fig. 18). 7/15/37. The solid circled line illustrates a minor fall (1.4°C) in the skin temperature of the fingers on the sympathectomized side accompanying experimentally induced tension, fear, anxiety, resentment, feelings of helplessness, frustration and guilt through discussion of the subject's maltreatment by her first husband and his attempt to injure their infant. The empty circled line illustrates, in contrast, the major fall, (8.0°C) in the skin temperature of the fingers on the intact side, simultaneously recorded.

Comment: During the period of disturbed affect induced by the interview the temperature of the fingers on the unoperated side showed a major drop. On the sympathectomized side there was practically no change in the temperature of the fingers, demonstrating that the stimulus for vasoconstriction during emotional stress reached the extremities *via* the sympathetic nerves. It is of interest that under the circumstances of these experiments (warm fingers) the temperature of the fingers on the sympathectomized side was lower than on the intact side (1.4°), during the period of observation (from 14 to 21 days, five observations) after

sympathectomy. The cause of this phenomenon is not considered relevant to our investigation. Before the operation the finger temperature was almost identical in both hands during relaxation as well as under emotional stress.

It is clear from these experiments and it is well to emphasize again that the bodily change represented in the fall in skin temperature is not only perceptible but may be of major propor-

conditions, in both warm and moderately cool environment. She had major drops in finger temperature in both warm (fall of 8.2°C) (Fig. 14) and cool environments (fall of 13.2°C) (Fig. 15) during emotional stress but pain and cyanosis of the fingers appeared only in the cool environment. The attack during stress was particularly severe if the body covering was not quite adequate and cooling occurred (Fig. 16). Follow-

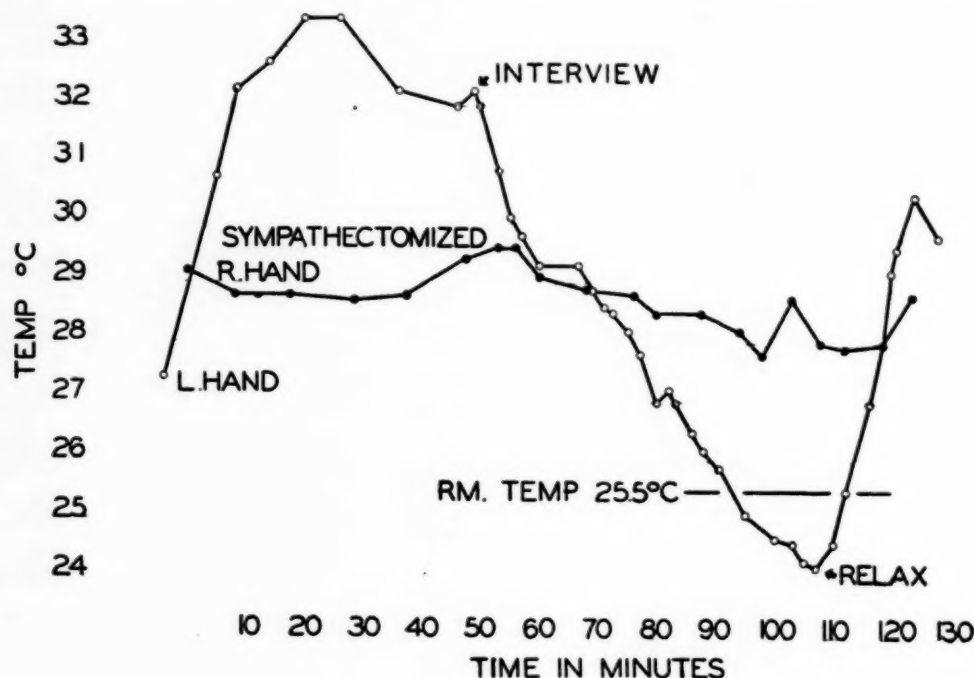


FIG. 18

tions. It has been shown that all individuals do not have equally intense vasomotor reactions to emotional stress, though some reactions are of a magnitude which, when sustained, jeopardize the well-being of the tissue supplied.

Summary: A timid, ineffectual woman developed attacks of pain and cyanosis (Raynaud's Syndrome) in her fingers during a period of hardship and emotional conflict. She was able to relax and maintained a high finger temperature (*ca.* 33°C) under "control"

ing sympathectomy, induced stress was not accompanied by fall in finger temperature of the respective extremity (Figs. 17 and 18).

SUMMARY

1. In this study both the emotional and physiological manifestations of the individual were studied simultaneously. Various affective states were induced experimentally through specifically devised situations in a standardized physical environment, and the

skin temperature recorded by radiometric methods. In another part of the study the affectively charged test situations were kept identical but the temperature of the environment was altered from one experiment to the next.

2. The magnitude of the fall in different individuals varied greatly, although the reaction in any one individual under comparable stress was approximately the same on repeated observation. The skin temperature of the fingers dropped as much as 13.5°C , the lowest level being 3°C below the environmental temperature.

3. The emotional changes that were accompanied by a fall in the skin temperature of the extremities were always complex, though one or two emotions prevailed. These affective states contained, in different subjects, various degrees of tension, anxiety, guilt, feelings of being pushed and of being thwarted, embarrassment, irritation, anger, rebellion, feelings of inadequacy and of being criticized or disapproved of, insecurity, humiliation, grief, feelings of helplessness, depression, despair and pleasurable excitement. Hence there was no specificity in the quality of the predominant emotion that was accompanied by a fall in the skin temperature of the extremities. Major drops occurred under emotional stress both with and without awareness on the part of the subject of his emotional state. The subject's reaction to a given situation was dependent upon his life experience, his values and his aims. Major drops occurred with a variety of emotional reactions interrelated with life situations that meant a threat to the subject's welfare or were charged for him with conflict.

4. Subjects who were under sustained emotional stress and who were not able to relax even in the control situation showed a low finger temperature both outside and within the control period. Subjects who could relax

in the control situation maintained a high finger temperature during the observation (32°C to 35°C). In such subjects during an induced affect, the magnitude of the fall in finger temperature in response to the same test situation was influenced by the subjects' dominant mood. Thus the fall was greater during a period of apprehension sustained for several days than during periods of sustained contentment.

5. Patients with Raynaud's Syndrome differed in no essential from other subjects in regard to the nature, the magnitude, or the speed of the fall in the finger temperature with induced stress. They differed dramatically, however, in that major falls in finger temperature were associated with pain, cyanosis and pallor. It is significant that a low environmental temperature in itself was not sufficient to precipitate pain and cyanosis in a patient who was adequately clad and relaxed, whereas emotional stress under the same physical circumstances was followed by distressing symptoms. Also, when a patient with Raynaud's Syndrome began to cool off as a result either of low room temperature or inadequate clothing a more severe attack of cyanosis and pain was precipitated by induced emotional stress than when the environment was warmer and the patient adequately clad. Thus, there was a striking interplay of the physical factors of body warmth, as determined by the environmental temperature and the body covering, and the emotional state induced by the situation. The interplay of these factors determined the amount of incapacity or pain the patient suffered.

6. Major drops in the skin temperature of the extremities under induced stress do not occur if the sympathetic nerve supply to the extremities has been interrupted.

7. Although vasoconstriction in the

extremities under circumstances of stress is usually a minor event in the reaction of the organism to life situations, it may acquire pathological significance in maladjusted subjects or in those reacting to life crises, and in patients with Raynaud's Syndrome.

CONCLUSIONS

Induced emotional stress was accompanied by a fall in the skin temperature of the fingers, the maximal drop being 13.5°C . During sustained stress the finger temperature of some individuals remained continuously close to that of the environment ("cold hands"). In a patient with Raynaud's Syndrome induced emotional stress precipitated attacks of pain and cyanosis in a temperature environment which in itself produced no attacks. Major drops in the skin temperature of the extremities under emotional stress did not occur when the sympathetic nerve supply was interrupted. In subjects with "cold hands", or with Raynaud's Syndrome, the degree of discomfort was the resultant of the interplay between the factors of emotional stress and environmental temperature.

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THE PRODUCTION OF "EXPERIMENTAL NEUROSIS" IN THE WHITE RAT*

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INTRODUCTION

IN A PRECEDING PAPER (2) the writer has described the methods used by other experimenters to produce abnormal behavior in various species of animals. The present report is of research concerned with the development of a technique for the production of behavior disturbances in the white rat.

It was believed desirable to attempt such a project for two reasons. First, an analysis of the incidence and nature of abnormal behavior in relation to the structural and behavioral differences between species should give us a clearer understanding of behavior deviations; consequently, it is desirable to add the rat to the species in which these phenomena are being or have been studied. Second, if it were possible to study disturbances of behavior in a laboratory animal as inexpensive as the rat, our experiments would be open to the participation of a far greater number of investigators.

Most of the experimentally-produced behavior disturbances in animals have been described in the literature as constituting examples of *experimental neurosis*. In the early history of the phrase its principal connotation was simply

that of a disordered condition of the nervous system which, more or less incidentally, developed in the course of an experiment. More recently the expression has assumed the character of an entity, by implication setting off experimental neurosis from other neuroses by reason of its association with the laboratory.

The development of a terminology with connotations that contribute to such an artificial separation must be deplored on several counts. First, it tends to confuse the fact that environmental stresses, in all likelihood, must have an essentially similar effect on the nervous system regardless of their laboratory or non-laboratory origin. Second, it plays into the hands of those individuals who incline, through ignorance or other cause, to reject the practical implications of all experimental investigations of behavior on the ground of some such shibboleth as "not true to life" or "artificial".

Because the eventual concern of the investigators who study behavior disturbances in animals is their implications for nervous disorders in human beings, another objection must be raised to the phrase, experimental neurosis. This has to do with the use of "neurosis" to cover all disorders of animal behavior. The differentiation of nervous diseases in humans into two major groups, psychoses and psychoneuroses, has gained wide acceptance. The common tendency undoubtedly will be to liken experimental neurosis to the psychoneuroses when, conceivably, certain of the animal reac-

* This paper was read in abbreviated form before the American Psychological Association meeting in Columbus, Ohio, on September 7-10, 1938. Previously its results had been submitted to the Department of Psychology at the University of Minnesota as a Ph.D. thesis. The writer is indebted to his adviser, Professor W. T. Heron, for much advice and technical assistance.

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tions may have an equal significance for the psychoses.

The most satisfactory way to have avoided these difficulties would have been to speak of "experimentally-produced abnormal behavior", at least until further differentiation and designation of reaction types was possible. Now, however, the extensive previous use of experimental neurosis excludes the probability of abandoning it for a less objectionable term. Attention must be directed, therefore, at defining and using the existing terminology in such a way that the unwanted connotations will be minimized, *i.e.*, to define experimental neurosis so as to include all experimentally-produced abnormal behavior. Enclosing the term in quotation marks in the title of this paper is intended to call attention to its use in this fashion.

Pavlov (3) identifies, at least by implication, experimental neurosis with a chronic, pathological disturbance of the cortex. This makes an unwarranted, though probably correct, designation of the cortex as the locus of the disturbance. Anderson and Liddell (1) use the phrase to describe "an abnormal state of the nervous system, experimentally produced" or "an enduring nervous disturbance". As with Pavlov's concept, this has the disadvantage of placing the seat of the disturbance in the nervous system (where it undoubtedly is) before this has been experimentally demonstrated. It seems preferable to limit the connotations of the term to the observed *disturbance of behavior*. A definition framed with this intention and in such a way as to include all persistent, behavior disturbances would read, "'experimental neurosis' is any chronic, abnormal behavior, experimentally produced".

At this point it will occur to many to ask the troublesome question, "What type of *experimentally-produced be-*

havior shall be termed abnormal or 'neurotic'?" The principal problem seems to be that of differentiating between temporary emotional outbursts and more lasting, generalized behavior disturbances. While such a differentiation will always involve the personal judgment of the observer to a large degree, it seemed wise to the writer to adopt as guides the following general criteria:

1. *Abnormal behavior must be maladaptive behavior:* That is, it is behavior which, in the opinion of the observer, achieves or is directed at an inferior mode of adjustment.

2. *Abnormal behavior must further be behavior which involves a change in a given animal's responses:* Thus, agitated, maladaptive responses to a given stimulus pattern (*e.g.*, two simultaneously-presented visual stimuli of different intensities) are not to be considered evidences of abnormal behavior, if such responses were given to this pattern at the animal's first contact with it. The maladaptive behavior must be shown to occur in response to a stimulus situation formerly met in a more adaptive fashion.

3. *Abnormal behavior, finally, must also be behavior which persists at least as long as the animal is in periodic contact with the precipitating situation:* That is, the modified behavior must be of long enough duration to distinguish between it and temporary emotional states from which recovery occurs despite the recurrence of the exciting stimuli. If recovery proceeds rapidly even though the contact with the precipitating stimulus pattern or patterns is repeated, the behavior is to be thought of as an emotional outburst rather than as abnormal.

These criteria have at least two consequences to which some opposition may be anticipated. First, criterion 2 prohibits the experimenter from term-

ing an animal's behavior abnormal solely on the basis of a difference between it and the behavior of other animals. Instead, the requirement is established that the behavior under consideration must represent a *change* between the animal's former and present responses to the same stimuli. This serves the purpose of providing assurance that observed behavior deviations are determined experimentally rather than pre-experimentally.

The second of the two consequences is that criterion 3 eliminates quickly-subsiding emotional outbursts even though it be demonstrated that such maladaptive behavior is the animal's habitual response to an environmental problem of stated difficulty. Since such outbursts may be brought to an end by the simple expedient of removing the precipitating environmental problem, they imply no necessary change in the reactive process itself. It is the phenomenon of a relatively permanent modification toward maladaptive behavior which it is important to produce and study in the laboratory and it is such a phenomenon which these criteria are intended to isolate.

Four experimental approaches have been made to the problem. Only the last of these has experienced any degree of success. However, because a comparison of the conditions of the first attempts with those of the last lead to an explanatory hypothesis, all four experiments will be described.

The procedure in each case has aimed to present the animal with stimuli to conflicting and mutually antagonistic responses. Each of the responses possessed considerable strength, either as a result of the animal's native reactive mechanisms or as a result of a long period of training. The experiments have differed principally in two respects: 1) The nature of the response called for, and 2) the amount of free-

dom allowed for other than the critical activity.

THE EXPERIMENTS

Experiment 1: A small tin cup was fixed into place in the center of a wire cage two square feet in area. The cup constituted the active electrode of an electric circuit, the cage being the inactive electrode. This circuit was made whenever a rat standing in the cage touched the water in the cup. A potentiometer in the circuit provided for variation of the current strength.¹

All experimental animals, five in number, for two weeks received all their water from this container. Each rat was allowed to remain in the cage thirty minutes daily. A large amount of dry food was kept in the living cages. During this same period the rats learned to perfection a 12-unit elevated maze. A *wet* mash was used as an incentive.

At the end of these two weeks the rats had formed the strong habit of rushing directly to the water cup when put in the experimental cage. The next step was gradually to increase the current strength in the circuit from an imperceptible point to a point at which the rat ceased drinking and withdrew. The intensity was then lowered slightly and, for a given animal, remained the same for the next seven days. During this time the rats drank little, if any, less water than formerly although they recoiled from the shock frequently each time they began to drink. Their behavior, however, gradually changed. A cautious approach to the cup was made and frequently the shoulders remained so far away that considerable

¹ Photographs and wiring diagrams of all the apparatus used in the experiments to be discussed may be found in the Ph.D. thesis, "The Production of 'Experimental Neurosis' in the White Rat", now on file in the University of Minnesota library.

neck-stretching was necessary to reach the water. Some retreating from the cup without touching it was noticed.

The following seven-day period was similar to this with one exception. Each time the rat overcame its initial tendency to recoil and began drinking, the shock intensity was increased rapidly, serving to again drive it away. The intensity was then reduced to the starting point (the previously determined level for each rat) and this procedure repeated until the thirty-minute period expired. This treatment materially lowered the daily water consumption and, as a result, the amount of food taken.

Several interesting modifications of behavior were observed under these conditions. Most frequent was the approach and withdrawal behavior in which the rat ran toward the cup, backed up rapidly, ran forward again, etc., repeating this a large number of times before either touching the cup or withdrawing to the side of the cage. Such withdrawal occurred frequently, with the rat usually giving itself a washing. A less frequent and more striking response to the situation was a quick run and leap up on the side of the cage.

The experiment ended with a three-day period in which the current strength was kept so high that the rat was unable to obtain more than a few drops of water. This resulted in fewer approaches to the cup although qualitatively the behavior remained the same.

During the entire time no modification in behavior outside the experimental cage was observed. No significant change in performance on the maze resulted, nor was there noticed any difference in response to handling by the experimenter.

Experiment 2: In the second approach to the problem a modification

of the Warner jumping apparatus was used. Two electric grids, enclosed in a box fifteen inches in length by six inches in width, were separated by a four-inch space. At the bottom of this space was a third grid, which was permanently sensitized. Thirteen inches above the grids was a milk glass plate and beyond this a set of four light bulbs. Transformers and potentiometers made possible the variation of current strength in all circuits. Ten animals were used.

The first response learned by the rat was to jump to the grid opposite the one on which it received shock. The current intensities were small; their magnitude was just large enough to keep the rats actively making avoidance movements.

The next act learned was to jump to the opposite grid when the box was illuminated by the bulbs at full intensity. A shock followed the illumination after a three-second interval. While this response was learned to the point where most of the shocks were avoided, it was, nevertheless, in constant need of reinforcement. This was indicated by the fact that several times in each experimental period failure to jump in the three-second interval resulted in being caught by the automatically-given shock. In order to make this habit very strong the experiment was continued at this level for two weeks following the attainment of an animal's best performance.

An inhibitory stimulus, the shining of the light at a very low intensity, was next introduced. Coincident with the appearance of the dim light the grid opposite the one on which the rat stood was sensitized. Thus, if a jump occurred the rat received a punishing shock as it came to rest. While this new stimulus caused a temporary disruption of the previous habit of a fast jump to the bright light, adjustment to

the situation was uniformly successful. In the case of several animals the same punishing shock had been used to prevent changing grids in the dark; for them, inhibition to the dim light brought little difficulty. Again, the experiment was continued at this level for one week after a perfect discrimination had been established.

Following this, the intensity of the inhibitory dim light was increased. At each point in the lower range of intensities the discrimination was perfected before further increase occurred.

On each new occasion where the animal experienced difficulty in the discrimination and jumped to a sensitized grid, a slowing of the bright light response occurred. This, in its turn, brought punishment. Where the discrimination was too difficult the rat was most often observed crouched on the edge of one grid, flexed for a jump. From this position a shock would send it quickly across to the other grid.

Since it appeared that the crouched, ready-to-jump position might represent the result of the unresolved antagonism of the tendency to jump and the inhibition against jumping, it was decided to lengthen this effect by increasing the interval between light and shock. This brought two results. First, the animals showed themselves capable of making a much finer discrimination than was apparent with the shorter interval. Second, certain modifications of behavior occurred. The animals gnawed the grids, explored a great deal even while being shocked and went down between the jumping grids although they had previously learned that punishment lay in that direction. Most striking, however, was a jumping upward, apparently another attempt to escape, continued in spite of the fact that they hit the milk glass plate with great force on each jump.

No behavior change outside the ex-

perimental situation was observed. It was possible to show, moreover, that behavior change in the situation was a purely temporary result of the failure to make a discrimination; when the dim-light intensity was lowered the animals would quickly fall back into stride.

Experiment 3: The third approach to the problem was essentially a modification of the second. The great increase in activity occurring under conditions of stress indicated that the experimental situation was successfully putting the animals under strain. On the hypotheses 1) that the increase in activity served to relieve the strain and 2) that eliminating the source of relief might have a disrupting effect, it was decided to limit activity by greatly decreasing the size of the apparatus. Accordingly, the boxes about the grids were made four inches long, three inches wide and four inches high.

It was also decided to construct a situation in which two overt responses rather than an overt and an inhibitory response, would be brought into opposition. To accomplish this, three grids were arranged symmetrically so that from any one grid an animal could jump to either of the other two across a five-inch space. At the bottom of this space was a permanently sensitized grid. Behind each of the jumping grids was a milk glass plate and a light bulb. The current strength in both the grids and the bulbs could be varied by means of potentiometers.

The rats, six in all, first learned that they could escape the shock on one grid by jumping to one of the other two. Frequently position habits were formed, such as regularly jumping to the grid on the right.

The next step was to teach the animals to jump to the lighted grid rather than the dark one. This was done by sensitizing the latter. If a rat jumped

to this grid, it received shocks until it turned and jumped to the correct position.

Since the light behind the correct grid flashed on three seconds before the rat was shocked on the grid where it stood, it learned not only to jump in the direction of the light but also to make the jump quickly. The discrimination between the two grids was learned to perfection but, as in the previous experiment, constant reinforcement was necessary to keep the response time under three seconds. This basic habit was firmly fixed by repeating the light-dark discrimination for two weeks after the best performance occurred.

Following this period, the previously darkened grid was illuminated by a dim light so that the rat was now faced with a choice between two illuminated grids rather than between a lighted and a dark one. While this was observed to attract the rats' attention and slow them down past the three-second interval, the interference was of short duration and did not affect the discrimination.

As the illumination behind the incorrect grid was increased, however, evidence of difficulty began to appear. This first took the form of looking back and forth from one grid to the other. Animals were often observed to lean in the direction of the incorrect grid and then change to jump correctly. Sometimes a rat would sway back and forth several times before a shock would send it in one or the other direction.

As stated in Experiment 2, it was felt desirable to prolong this vacillating behavior rather than have it cut short by shock at the end of three seconds. Accordingly, when the discrimination had become so difficult that most choices were forced in this manner, the time interval between light and shock was greatly lengthened. This was not done, however, until ample time had

elapsed to see what would develop under the short-interval conditions.

With the exception of the upward jumping, which was impossible in this apparatus, all the phenomena recorded in the previous experiments were noted. Gnawing the grids was frequent. Trips down to the strongly sensitized central grid often occurred. Turning away from the two lights to fight to get out in a corner at the rear was common.

Again, however, if the discrimination were made easier the old habit was easily reestablished and excitement abated. No effects outside the apparatus could be seen.

Experiment 4: The most recent experiment was designed to restrict further the rat's freedom of movement during the critical periods. A stand was constructed with holes through which the legs could be drawn and fastened.² As a result, when in the stand, the animal rested on its chest and abdomen. It was held in place by a broad leather strap passing around the back and narrower straps around the head and tail. All movement other than struggling was thus impossible.

The right front leg was fastened by a thong to a lever on which were balanced two mercury switches. These switches, when thrown, closed either a circuit carrying a shocking current or one activating a food-releasing device.³ The active electrode of the shocking circuit was bound to the right front leg near the ankle. The inactive electrode was a wet pad under the rat's stomach. The food-releasing device fed small pellets, one twenty-fifth of a gram in weight, into a cup under the rat's head.

One foot from the front of the stand was a single light bulb. The intensity of the light from this bulb, as well as the strength of the shocking current,

² This stand, with minor exceptions, was devised by G. Hamilton Crook.

³ This food-releasing mechanism was devised by Drs. B. F. Skinner, and W. T. Heron.

could be regulated by potentiometers.

The first association learned by the rat was one between the shining of the bulb at full intensity and the appearance of food. This resulted from delivering pellets automatically a fraction of a second following the light. Anticipatory movements of the head signaled the acquisition of the relationship.

Next the rat learned that while the light shone, a flexion of its right leg brought food. To develop this response, automatic feeding was brought to an end and right leg flexions forced by a pinch or a tap on the foot. The flexion gradually became voluntary, and later followed the light flash instantaneously. Several weeks of daily experimentation served greatly to strengthen this habit.

As the rat learned to get its food with the lever, he began yanking it upward during the intervals between lights as well as when the light came on. Because it was felt that this would make it difficult later to tell whether or not an incorrect pull was stimulated by the dim light, an attempt was made to eliminate these responses. This attempt (partially successful) consisted of giving the animal a light shock each time it threw the switch while no light was on. The shock intensity was the smallest that would elicit a barely perceptible squeal.

The inhibitory stimulus, the shining of a dim light, was next introduced. A right-leg pull to this light brought a punishing shock. After a discrimination between this and the bright light had been made, a number of experimental periods were spent strengthening the responses involved. Each time it was used, the inhibitory dim light was kept shining for five seconds or until the rat made the prohibited leg flexion and was punished.

The rat was next trained to inhibit to two dim lights in succession. This eliminated the necessity of always fol-

lowing the dim light with the bright one and, accordingly, increased the possible sequences of stimuli which might be brought into the discrimination.

When these basic habits had been well learned and strengthened over a period of time, the intensity difference between the bright and dim lights was gradually decreased by increasing the intensity of the latter. At each new level where a rat experienced difficulty, further increase in dim-light intensity was postponed until two-thirds or more of the possible responses were correct. This continued until the limit of discrimination was reached. Each day, however, the experimental period began with easy discriminations and worked up gradually to the failure point. This daily reinforcement was made because it was believed that the stronger the antagonistic responses at the moment of discrimination became difficult, the greater would be the resulting stresses.

Six animals have been brought through this procedure. Certain behavior has been common to all six; in many other respects they have reacted very differently. Three have shown behavior changes which have been interpreted as manifestations of an "experimental neurosis" while the others, on the basis of the definition of the term as advanced in the Introduction, have not had their behavior so labelled.

The first period of stress for the rats came as a result of the attempt to increase the length of the interval between pellets. When pulls which occurred in the absence of the bright light went unrewarded and later when they were punished, clear evidence of disturbance appeared. Unrewarded pulls often were accompanied by squeals; at other times, they were followed by violent struggling. On certain occasions every pull of the leg, whether rewarded or not, elicited a squeal. Fre-

quently a continuous low squealing occurred between trials. Toward the end of a period a touch on the rat's leg or back would start it squealing. Likewise, a tap on the tail elicited reflex jerks of the legs.

The second stress-producing element of the situation entered when the dim light was introduced. This served, usually, either to exaggerate the behavior just described or to bring out portions of it which had not until this time emerged.

Rat No. 1: During the effort to lengthen the delay between pellets, Rat No. 1 showed all the behavior described above in exaggerated form. Leg jerks without the light were often punctuated by piercing screams. So tense did the animal become at times that a light touch on the tail would cause it to snap away. The same stimulus brought an exaggerated reflex contraction of the legs. Loud squealing was common and might occur with or without an accompanying yank at the lever.

Actually, all the behavior disturbances that this rat showed (in the apparatus) throughout the experiment were observed in these early periods. As the training advanced through the introduction of the dim light and its gradual increase in intensity, the disturbances increased in magnitude but no new ones appeared. The dim light, as might be expected, became the signal for many outbursts of squealing and general body stiffening.

Persistent behavior changes that could be observed outside the apparatus likewise developed gradually. First noticed was a slight jumpiness to a light tap from the finger; later, this jumpiness became very marked. At approximately the same time as the onset of the jumpiness the rat showed a progressive inclination to avoid the experimenter's hand in the cage. This took the form of backing slowly away as the cage door was opened, pushing

the experimenter's hand away with its forefeet, turning over on its back when the experimenter attempted to lift it, squirming out of the experimenter's hand, etc.

It was next observed that the rat tended to stiffen and remain motionless when the experimenter's hand rested on it. As time went on this tendency developed to the point where the animal could be made to hold any sort of pose almost indefinitely. For instance, all that was necessary to keep it motionless on its back in a sort of catatonic rigidity was to maintain sufficient contact with its feet to keep it balanced.⁴ The animal now began to squeal whenever it was lifted and often when it was merely touched.

Irregular, temporary refusals to work in the apparatus were frequent. On these occasions the normally strong response to the bright light was completely inhibited. These cessations of activity might last for five minutes at the beginning of a period or might come later. In some cases returning to an easier discrimination sufficed to restore the pulling response; in other cases, the animal refused to eat and could by no method be coaxed to resume work that day.

However, much more characteristic of its performance in the apparatus were the occasions upon which the rat lost all inhibitory ability. A more or less unbroken series of flexions of the foreleg would result, interrupted only by the short intervals required to eat the pellets. The capacity to inhibit sometimes returned to the animal when the dim light was moved only a few steps down the intensity scale. At other times, even the slightest illumination continued to evoke a sharp response.

Confirmation of the fact that the experimental situation provided the etio-

⁴ This hypertonic immobility resembled closely the behavior of a vanquished rat whose conqueror remains standing above it.

logical conditions for these behavior changes was had when the animal was given a rest. For a 9-day period it remained away from the experimental room altogether, while during the next 11 days it was put in the apparatus on only four occasions. At the end of this time most of the abnormal behavior had completely disappeared. The rat was less jumpy to being touched unexpectedly than it had been formerly. Although the response of stiffening and holding poses was still evident, it was considerably less severe; relaxation occurred rather quickly. Little change was shown in the animal's active avoidance of the experimenter's hand while in the living cage.

Three weeks after daily experimental periods had been resumed, all symptoms, with minor exceptions, had returned in full force. Excessive jumpiness to a sudden touch and squealing at every contact with the hand had not returned to their pre-rest extent; however, a milder jumpiness and frequent squealing when lifted were present. The animal, if touched, would now hold itself motionless almost indefinitely. There were infrequent periods in the apparatus when all activity was inhibited as well as the almost daily periods during which there was a loss of inhibitory capacity.

More exaggerated than ever were the reactions in the apparatus. Spontaneous, piercing screams were accompanied by general body stiffening, throwing back the legs, flipping the tail straight up in the air, etc. On the last day of the experiment this behavior continued for an hour with the greatest violence, despite the fact that the experimenter was feeding the pellets automatically without using the light stimuli.

Rat No. 2: While Rat No. 2 showed the same initial behavior disturbances in the apparatus, its subsequent response patterns were very different.

Two principal modifications of behavior were noted.

First, the animal began to sleep a great deal in its cage. This was called to the experimenter's attention, approximately a week following the introduction of the dim lights, by the fact that the sleeping continued up to the time of removal for the daily experimental period. Such behavior is in marked contrast to a rat's customary increase in activity as feeding time approaches.

At this time the animal was on a daily food allowance of 13 grams of food, a quantity which had kept it sufficiently motivated to proceed successfully through the previous experimentation. Now a lowering of this ration was begun and continued until a daily allowance of 9 grams was reached. On this quantity the animal gradually lost weight.

With such a restriction in food the sleeping reaction gave way gradually to a waking-state lethargy in which the rat crouched in front of the cage door but would not stir enough to investigate a touch from the experimenter's finger. This, in turn, gave way, when the 9-gram stage was reached to a more alert waiting at the door. Touches were investigated and the door-opening occasioned exploratory behavior.

The second modification of behavior was observed in the apparatus. A few days following the point at which the inhibitory lights had become a part of the daily procedure, the rat became completely inactive for between 2 and 3 minutes while both inhibitory and excitatory lights continued to flash on and off in front of it. During these periods the eyes were either closed or narrowed to mere slits. On many occasions a slight twitching of one or more of the limbs was observed. While this behavior was identical with the cessations of activity observed in both this rat and Rat No. 1 during the delay-

lengthening phase of the experiment, special attention was now called to it because of its occurrence on several days in succession.

Two weeks later when the animal had reached the point where it was being required to make very difficult discriminations, this same behavior again occurred. Again, however, it disappeared after four days, only to reappear permanently a week later.

The two weeks following this final return were marked by an increase in the length of the inactive periods. Some of them lasted until they were brought to an end by tactual stimulation from the experimenter. A short rest in the dark followed by a flash of the bright light also would often be sufficient to restore the pulling response.

On some occasions the periods were precipitated very early and at an intensity of the dim light which had previously been easily discriminated. On the other hand, some days would find the rat making the most difficult discrimination for a few trials before finally becoming motionless.

The reduction in rations seems to have had, at the most, only temporary effects on this behavior. On the 9-gram quota, it still made a frequent and unpredictable appearance. Likewise, although a strong punishing shock probably brought it on more quickly, a general inhibition of activity was frequently observed to occur when shock was absent altogether.

Two weeks' rest from the experiment produced a change in one of the rat's symptoms but left the other seemingly unmodified. Where, previously, the animal had been consistently inactive or very slow-moving, feeding time now found it exploring about the front of its cage in a much more normal fashion.

No such return to normal marked the animal's performance in the apparatus. The events of the two weeks following the rest period resembled

very closely those of the two weeks preceding it. The rat lapsed into its motionless state on very frequent and unpredictable occasions. Sometimes the pulling response returned after a few minutes; at other times, it appeared as though it would be inhibited indefinitely unless restored by interference from the experimenter.⁵

Although during these last two weeks the animal was still on a 9-gram ration, its activity again became limited to a more or less motionless crouching in front of the cage door. However, its condition was not as severe as it had been previously. On infrequent occasions it would be seen to rise slowly on its back legs to some such stimulation as jarring the cage; likewise, an occasional trip across the cage was noticed. However, the contrast with the cage behavior at the end of the rest period was marked enough to be quite obvious.

Rat No. 3: Rat No. 3 responded to the experimental stresses in yet a different fashion. This animal, when it began the experiment, was already predisposed to "emotional" behavior. After being in the experimenter's hand for a few moments it could be counted on to begin a struggle to escape. When placed in the experimenter's lap preparatory to having the leg straps put on, it invariably began climbing upward. Any attempt to halt it would elicit struggling, defecation and urination.

In contrast to what might be expected from this behavior, the rat made a quick adjustment to the habit of eating from the food cup while strapped in the apparatus. Within three days it was consuming pellets as rapidly as they were offered.

Similarly, it learned very quickly to secure the next pellet by voluntarily flexing its foreleg. However, on two of

⁵ On one occasion the rat was allowed to remain motionless for one-half hour.

the four days that elapsed between the first forced flexions and the perfection of the habit, the animal after taking 20 to 25 pellets ceased eating and began an almost constant struggling. This behavior was thought to be due to the continued excitement aroused by the experimenter when he was stimulating the foreleg to force responses.

Following the point where the forced pulls were no longer needed and before any attempt was made to delay flexions until the next bright-light stimulus, calm, regular eating without struggling was the rule.

More in line with pre-experimental impressions, however, was the fact that this rat never made a complete adjustment to the problem of delaying its foreleg responses until presented with a bright light. Moreover, as time went on, there occurred insidious changes in behavior which finally brought the animal to the place where it no longer possessed the capacity to repeat its first simple adjustment—that of taking food in the apparatus.

During the first few periods in which delays were attempted, the animal gave foreleg flexions with scarcely a break, struggled more and more frequently as time went on and, finally, after eating 20 to 30 pellets refused to take more although they were numerous in the cup in front of it. This pattern of response was noticed both previous to and following the day on which the interval flexions were first punished with shock.

After a week of such behavior the rat had added to its progressively more violent struggling the practice of chewing continually the edges of the metal food cup. In order to eliminate this, a closely fitting tin hood was placed over its head. The hood allowed head movement for only a fraction of an inch to either side.

During the week in which the animal was thus restrained, the number of

pellets eaten per experimental period fell to between 10 and 15. Struggling began earlier and grew violent much sooner. Even more significant is the fact that during the next week, although the hood was no longer used, conditions became steadily worse. Irregular eating had now become the rule. Instead of consuming the pellets, one by one, as they fell into the cup, the rat would take food only between periods of struggling. On certain days as few as five pellets were eaten. Uneaten food was usually chewed into small pieces.

During the several weeks just previous to this point, the rat slept until the experimenter came to take it from the cage. When awakened, however, unlike Rat No. 2, it would run to the door.

In an effort to make the animal eat more regularly so that the experiment might be continued, its food allowance was cut in half for 10 days. Since the full ration was just enough to maintain normal weight, the reduction resulted in a rapid weight loss. This seemingly did not affect the animal's behavior, either in the apparatus or in the cage.

A week's rest was now given. At the end of this period cage activity near feeding time had shown a noticeable increase. Behavior in the apparatus, however, showed no improvement. For four days after the rest the usual program of rewarding bright-light flexions and not rewarding, or punishing, the many interval flexions, was continued. Then this was abandoned and for the next three days a pellet was given at every pull, *i.e.*, no further delays were required.

Since this, likewise, failed to increase the number of pellets eaten or decrease the amount of struggling, the situation was further simplified during the last nine days of the experimentation by feeding the pellets automatically. In other words, the animal was presented,

objectively, with the same problem it met at the very beginning of the experiment. Now, however, and in contrast to its previous successful adjustment, food continued to be largely refused and struggling began almost immediately after the start of the period. Seldom did the number of pellets taken exceed five, and on many days none were eaten.

In the week following the week of rest a marked decrease in cage activity again occurred. On most days, at least for several hours just preceding the experimental period, it was impossible to make the animal get on its feet by any means less direct than touching it. It might look up momentarily to a loud noise or when the cage was shaken, but it was soon apparently asleep again.

The fact that on several occasions during the interval in which the rat was on half rations it was seen asleep with uneaten food in the cage, points to the probability that the experimental situation temporarily disrupted the hunger drive.

The remaining rats, Nos. 4, 5, and 6, failed to exhibit any modifications of behavior which paralleled, either in intensity or permanence, the changes that have been described up to this point. The greatest energy was directed at this trio in an attempt to reproduce one of the syndromes shown by the other animals. The daily experimental periods were lengthened until, on most occasions, they extended over more than an hour. The close-fitting tin hood was used whenever unusual activity of the head appeared. The rats were called upon to make difficult discriminations for many trials in succession and to endure many long delays. It is safe to say that, from the standpoint of an observer, the environmental conditions imposed on these animals were far more severe than those under which the first rats succumbed.

Although no lasting changes oc-

curred there was abundant evidence to indicate that these rats experienced strain in the problem situation. Squealing, tenseness, jumpiness, etc., while in the apparatus, seemed as marked as in the other animals. This was especially true of Rat No. 4, part of whose behavior in the apparatus approached in severity that of Rat No. 1. The low threshold of squealing and the exaggerated withdrawal response of the tail both were observed quite regularly in this animal. Often these two types of response could be elicited very shortly after putting the rat in the stand. On several occasions so pronounced a loss of inhibitory power occurred that it extended downward to include normally very easy discriminations. However, this was neither regular enough nor frequent enough to assume the character of a consistent mode of reaction. No change in behavior outside the apparatus was noticed.

Rat No. 5 for almost two weeks gave a type of reaction not observed in the other animals. After being returned to its cage following an experimental period, it was excessively jumpy to such stimuli as a clap of the hands, a tap on the cage, a puff of air, etc. If caught unawares, it might jump so violently as to leave the cage floor entirely. On several occasions, this condition persisted with lessened intensity for 24 hours and could be observed prior to the next experimental period. On other days during these two weeks it was completely absent.

Rat No. 1, it will be remembered, gave similar exaggerated responses when touched unexpectedly. Strangely, however, neither of the animals was hypersensitive to the stimuli which affected the other. Rat No. 5, when out on the testing table, paid little attention to unexpected taps from the finger, while Rat No. 1, when in the cage, was similarly indifferent to the stimuli which aroused No. 5.

Because the behavior change in the latter animal disappeared after a relatively short stay (10-12 days), it appeared wise not to group it with the more permanent changes observed in Rats 1, 2, and 3—this in spite of its obviously abnormal and temporarily-persistent nature. Until all the phenomena discussed in this paper are more clearly understood such a separation is admittedly, of course, altogether arbitrary.

DISCUSSION

Two principal questions are raised by the facts which have been described. First, what are the conditions essential to the precipitation of an "experimental neurosis" in the rat and how do these conditions compare with those under which similar phenomena have been produced in other animals? Second, what are the principal symptoms of "experimental neurosis" in the rat and how do these symptoms compare with those observed in other animals? Because of the small number of rats experimented upon, answers to both these questions must be tentative. Interpretation is further complicated by the unexpected finding that each rat exhibited a reaction pattern quite different from that of the others.

One of the most suggestive sources for an answer to the first question is a comparison of the three unsuccessful experiments with the successful one. As stated previously, the extremely agitated escape responses observed in Experiment 2 led to the formulation of the hypothesis that such activity served to relieve the strain generated by the experimental situation. When, in Experiment 4, this hypothesis was tested by presenting other animals with essentially the same stimulus situation under conditions which greatly limited activity, half of them developed persistent, abnormal modes of reaction.

The inference to be drawn is in support of the hypothesis, *i.e.*, if, in a stressful situation, activity other than that involved in the critical response is sufficiently limited, an "experimental neurosis" will result. This implies, of course, that such additional activity in some way negates the neural effects to which the situation has given rise.⁶

In 1935 Anderson and Liddell (1) advanced an identical hypothesis in relation to the effect of restraint on the production of neurosis in the sheep and dog. After calling attention to the fact that "experimental neurosis" had developed in these species only in the conditioned reflex situation, these authors say "It is reasonable to imagine that locomotion, or more generally, spontaneous neuromuscular activity, provides an escape from situations to which adequate adjustment is difficult. A difficult problem faced implies increased nervous tension (increased cerebral excitation or inhibition, according to Pavlov's theory), but the neuromuscular mechanism provides an outlet through which this tension may be lowered by the performance of random muscular movements. According to this point of view, the most striking feature of the conditioned reflex method is that through training spontaneous activity is suppressed, with the consequence that the animal can be forced to attempt difficult adjustments such as reacting to stimuli presented according

⁶ Alternative hypotheses that might be offered to explain the success of Experiment 4 in comparison to the first experiments are: 1) Different animals were used in all experiments. Chance selection may have brought to the final experiment a group of animals particularly predisposed to develop abnormal behavior. 2) The hunger drive was added in Experiment 4. Its effect may be more intense than the "drive" to avoid punishment, the only drive used in Experiments 2 and 3. 3) A limited number of muscle groups responded at high speed in Experiment 4 whereas in the previous situations a relatively slow gross body response was utilized. The neural consequences of opposing excitatory and inhibitory responses may be more severe in the case of a fast, localized response than in a slow, generalized one.

to a rigid schedule and discriminating between closely similar rates of ticking of a metronome. We believe that when a serious problem of adaptation or adjustment is presented to the animal in the laboratory, nervous tension is generated because evasive activity has been repressed through training. If the difficulty is beyond the animal's powers of successful response a nervous breakdown ensues because the demands of the situation exceed the capacity of the nervous system for sustaining the required tension".

In addition to restraint, other conditions of the experimental situation which are thought to be crucial were abstracted from observing the behavior of the rats at different stages in the experiment.⁷ As already pointed out the principal disturbances appeared to occur at two points: 1) when the rat was required to delay its food-getting response until it received the next light signal; 2) when a difficult discrimination between bright and dim lights was attempted.

In both these cases it seems reasonable to characterize the situation as one which gave rise to a "clash" between the neural activity of initiating a response and the neural activity of inhibiting the same response. In the first instance, the neural activity underlying the hunger drive acted to initiate a foreleg flexion. Impulses arising out of past experience with punishment or non-reward acted to inhibit such a flexion. In the second instance, where a dim light had become a sign for inhibition of the flexion and the bright light

a sign for its excitation, an imperfect discrimination resulted in a tendency to arouse both processes.

Pavlov (3) stated such a generalization with regard to his experiments on dogs in the following fashion, "Broadly we can regard these disturbances as due to a conflict between the processes of excitation and inhibition which the cortex finds difficult to resolve".

When the experimental situation which proved successful with the rats is compared to the situations in which an "experimental neurosis" developed in other animals⁸ the following similarities appear:

In all of the successful experiments, with the exception of those involving the chimpanzee and the cat, the subjects were restrained from making any very considerable gross bodily movement both by mechanical devices and by previous training to remain quiet.

With the same exceptions the response utilized involved only a limited group of effectors, *i.e.*, those involved in leg flexion, head movement, mouth-opening or glandular response.

In all of the species experimented upon, a situation requiring a discrimination between two similar stimuli which evoked antagonistic behavior proved adequate to produce behavior disturbances. In the rat, of course, the effect of such an attempt has not been isolated from that of the rest of the situation.

In answer to the second question, concerning the principal symptoms of "experimental neurosis" in the rat, little more could be done than repeat the descriptions already given. The syndromes of the three animals are different enough so that a common pattern cannot be isolated.

However, it is possible to draw a striking parallel, in some respects, be-

⁷ In the absence of control experiments, the following parts of the experimental situation have been arbitrarily eliminated as not in themselves effective in producing the disturbed behavior: 1) the electric shock and 2) daily confinement in the apparatus. These are regarded rather as means which made the production of the behavior possible. On the basis of other experience it is quite safe to conclude that rats could undergo much more shock and confinement than they experienced in this experiment without suffering ill effects.

⁸ For a description of the experiments on "experimental neurosis" in other species, see the writer's survey of the literature (2).

tween the behavior of each of the three animals and behavior observed in other species. The temporary but regular loss of inhibitory capacity which was characteristic of Rat No. 1 is similar to the more permanent losses of inhibition reported in dogs of the "excitable" type, in certain children, in sheep and in the dove. An accompanying restlessness and struggling was present in all species. A close parallel to this rat's active avoidance of the experimenter's hand in the cage is to be found in reports of the antagonism which developed in children and sheep toward being taken to the laboratory.

Likewise, in Rat No. 2, the regularly developing periods when all leg flexions were suspended resemble the loss of response reported in the "inhibitable" type of dog, in certain children and in the pig. The difference, again, seems to be one of degree. Where in these latter animals the loss persisted until retraining was undertaken, the rat exhibited merely an increased readiness for the development of such inactivity.

Finally, the increasing excitement of Rat No. 3 as it spent more and more time in its unsuccessful attempt to inhibit flexions during the no-light intervals, finds a close parallel in the conduct of two of the disturbed sheep. These animals were unable to inhibit their defensive leg withdrawals responding to unreinforced as well as reinforced stimuli. From a state of relative calm at first they, like the rat, grew more and more excitable and restless, struggled with increasing violence and finally became more or less unmanageable.

It is also true, on the other hand, that what has been discovered in the case of the rat is apparently quite different, in some respects, from abnormal conditions of other species. For instance, nothing comparable to the pose-holding behavior of Rat No. 1 has been reported. Likewise, the general decrease

in activity observed in Rats Nos. 2 and 3 seems not to have developed elsewhere. A fact that may be of significance from a comparative standpoint is that the onset of changes observed in the rat was, in all cases, very gradual. While gradual changes have been reported in other animals, the majority of disturbances have had a rather rapid onset—some within the course of a single experimental period.

SUMMARY AND CONCLUSIONS

As a consequence of continued contact with a stressful situation, three of a group of six white rats developed disorders of behavior. Although these disorders formed a different pattern in each animal, all have been considered manifestations of an "experimental neurosis", this expression having been defined to mean "any chronic, abnormal behavior, experimentally produced".

The experimental situation and its stressful elements were as follows: The rats were strapped to a stand so that the only sizeable limb movement possible was a flexion of the right foreleg. Under certain conditions such a flexion was rewarded with a food pellet; under other conditions it was punished with an electric shock.

Observation indicated that the animals experienced two principal stresses: the first, when they were required to delay the food-bringing flexion until they received a bright-light stimulus; the second, when they were required to make a very difficult discrimination between a bright-light stimulus which permitted a food-bringing flexion and a dim-light stimulus which prohibited such a flexion on pain of shock. Because, under such conditions, the organism was receiving simultaneously stimuli to the excitation and inhibition of the same response, the stresses experienced have been characterized as comprising a "clash" between the neu-

ral activity of initiating a response and the neural activity of inhibiting the same response.

A comparison of this successful experiment with three previous experiments led to the belief that to produce enduring disturbances it is necessary to limit activity as much as possible to the critical response. This carries the implication that extraneous activity in some way negates the neural effects produced in the stressful situation.

Rat No. 1 developed the following behavior disturbances: 1) An increasing tendency to react to the problem by a regular but temporary loss of the capacity to inhibit flexions of the foreleg. 2) Spontaneous, loud squealing accompanied by general body and tail stiffening. 3) An exaggerated jumpiness and tendency to stiffen when touched. 4) A practice of inhibiting postural reflexes (holding poses) for long periods when in contact with the experimenter's hand. 5) A tendency to squeal when touched or lifted. 6) An active avoidance of the experimenter's hand in the living cage.

Rat No. 2 showed the following changes in behavior: 1) An increasing tendency to react to the problem by a regular, but temporary, loss of the capacity to flex the foreleg. 2) Greatly decreased activity in the cage, including sleepiness and an indifference to certain stimuli normally adequate to excite exploratory behavior.

Disorders of behavior observed in Rat No. 3 are: 1) The loss of a previous habit of eating while strapped in the apparatus. 2) Struggling in the apparatus so continuously and so violently that further experimentation was useless. 3) Greatly decreased activity in the cage, including sleepiness and indifference to certain stimuli normally adequate to excite exploratory behavior.

Although the data are as yet very limited, it seems possible to offer the following tentative conclusions:

1) When presented over a period of time with a single stimulus or simultaneous stimuli to mutually antagonistic responses, a certain proportion of white rats will develop an "experimental neurosis".

2) It is necessary to the development of an "experimental neurosis" that activity other than that of the responses utilized in the stressful situation be very limited.

3) In the white rat the symptoms of "experimental neurosis" may assume a different form from one animal to the next.

4) Adult white rats possess in varying degree a constitutional predisposition to the development of an "experimental neurosis". This predisposition will, in part, determine the degree of stress necessary to produce the behavior disturbance as well as the pattern of the behavior produced.

In order to avoid any possible misinterpretation by the reader, it seems wise to restate the author's position on the comparative value of these experiments for human psychiatry. It is his conviction that the contributions to be made to psychiatry by the study of this problem will be realized only after the total picture of the appearance and disappearance of experimentally-produced behavior disturbances has been described and understood. From this comprehension of the total process and not from comparisons based on specific details, should come valuable suggestions for explanatory concepts and therapeutic devices.

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THE EFFECT OF FRUSTRATION ON HOARDING IN RATS

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THE CONCEPT OF FRUSTRATION has recently achieved considerable importance in the theorizing of psychologists and psychopathologists. It is usually defined as thwarting of expected satisfaction, and is conceived to have consequences differing from those resulting from simple deprivation which involves no thwarting. One of the consequences frequently considered is an increase in the drive for the satisfaction expected. The experiment here described was conducted to demonstrate a difference between the effects of frustration and deprivation.

A rat kept on a subsistence diet for periods approximating a week will not merely eat when finally presented with a superfluity of food; it will remove pellet after pellet, add them to its store, and return for more. This we call the hoarding reaction. This reaction may be quantified by observing 1) the number of pellets taken up to an "empty" interval of specified magnitude, or 2) the number taken in a given unit of time. This experiment was designed to determine what effect frustration (consisting here in the removal of a goal object, food, in the course of satisfaction), as contrasted with mere deprivation (lack of possession of quantities of the goal object adequate for satisfaction), would have upon the hoarding reaction as so quantified. In accordance with theory, it was anticipated that the frustrated animals would hoard more and for a longer period than would those simply deprived.

Twenty albino rats, 10 females aged 55 days at the beginning of the experi-

ment and 10 males aged 220 days, were confined in circular bird cages 18 inches in diameter and 24 inches high, and kept in semi-darkness except during experimental feeding. For one week they were fed 2 pellets of food ($1" \times 1" \times \frac{1}{2}"$) in the morning and 2 more in the afternoon (an adequate ration). During the second week they were fed only one pellet twice a day (a subsistence ration). Then for $3\frac{1}{2}$ days the

TABLE I

	To be Deprived	To be Frustrated
Females	215	73
	43	22
	16	16
	15	14
	10	7
Males	266	157
	165	138
	98	69
	66	61
	42	28

hoarding reaction was measured by supplying, twice a day, pellets to each rat until it allowed a period of 3 minutes to elapse without taking any (or until it had taken 100). These were wedged between the vertical bars of the cages so that the rat was forced to make an effort for each one. On the basis of these measures pairs were matched in each sex group on the basis of this initial strength of the hoarding reaction. These pairs and their corresponding measures (total number of pellets during $3\frac{1}{2}$ days) are presented in Table I.

These matchings were "loaded" in favor of the animals to be deprived, in order to prevent selection in line with the theoretical predictions. This

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loading may account for the slight excess of hoarding shown by the "deprived" rats (Table II).

When these measurements had been completed, the rats were subjected to the experimental procedure proper: The "deprived" member of each pair was fed half a pellet twice a day and allowed to consume it unhampered except for the entrance of the experimenter's hand into the cage at the expiration of the meal. The "frustrated" member was given a whole pellet at the same time, but when the deprived rats had finished their meal the remainders of the pellets were taken from the frustrated rats. The actual rations and any shocks from handling were thus approximately equated.

At the end of 8 days of this procedure the strength of the hoarding reaction was again measured, this time by observing the numbers of pellets taken in each successive 5-minute period up to 25 minutes. These measurements were continued for 8 days. As the individual curves of consumption proved of no significance, only total quantities taken each day are presented. The results are shown in the following tables.

Table II should be read: All the female "deprivates" together took 225 pellets in 25 minutes on Day 1, 255 on Day 2, etc.; in the whole 8 days all the

female deprivates took 1636 pellets, all the female "frustrates" 1565. Table III should be read: the first female deprivee took 284 pellets in the 8 days,

TABLE II

Days	Females		Males	
	Deprived	Frustrated	Deprived	Frustrated
1	225	121	383	277
2	255	290	386	341
3	214	252	415	343
4	199	224	315	301
5	214	162	119	202
6	208	122	191	91
7	178	211	160	82
8	143	183	81	83
Total	1636	1565	2050	1720

TABLE III

Female pairs		Male pairs	
All Days		All Days	
Deprived	Frustrated	Deprived	Frustrated
284	643	250	220
417	413	604	481
366	235	499	279
523	137	284	407
46	137	413	333
1636	1565	2050	1720

while her matched frustrate took 643 pellets, etc.

Since no clear difference is shown (and certainly no difference in favor of the frustrated group), it is concluded that the hoarding reaction in rats is determined chiefly by deprivation, and that it is unaffected by the frustrating procedure employed.

REVIEWS, ABSTRACTS AND CORRESPONDENCE

CARDIOVASCULAR NEUROSIS—A REVIEW*

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THE SYMPTOM COMPLEX known as cardiovascular neurosis is composed of psychological and physiological components mixed in a confusing manner. In no group of cases can the casual observer more readily see evidences of nervous strain, personality defects and psychic trauma. Equally clear, however, is the objective evidence of a circulatory abnormality sufficient to mimic the physiologic disturbances of organic disease.

DEFINITION

"Cardiac psychosis" is customarily used to describe confused mental states occurring as a symptom of heart failure (143). "Cardiac psychoneurosis" is a satisfactory label for those cases in which fear of heart disease is accompanied by no objective signs of disturbed circulation (53). If these groups be separated off, the term "cardiovascular neurosis" may be restricted to those cases in which symptoms and signs of circulatory origin are present but cannot be explained on the basis of pathological changes in the cardiovascular apparatus.

Since some symptoms referable to the heart occur in almost all neuroses (20) a further limitation is indicated; the term "cardiovascular" being applied only to those neuroses in which

the circulatory manifestations are the dominant subjective and objective features of the total clinical problem.

If these rather artificial definitions be accepted for practical purposes, the term cardiovascular neurosis includes those cases which have been described as "irritable heart" (42, 86), "disordered action of the heart" (62, 75), "effort syndrome" (77), and "neuro-circulatory asthenia" (97). The principal advantage of the name "cardiovascular neurosis" over the above terms, and others which have been suggested, is that it emphasizes the dual nature of the problem, the cardiovascular component related to clinical medicine, and the neurosis component beyond the scope of a purely physiological analysis.

THE CLINICAL PICTURE

A case report, which emphasizes findings common to this group of patients, is presented:

Patient C. White male. Age 30 years.

Chief Complaint—"heart disease for several years".

Family History—Father died suddenly, age 50, of "angina". Mother living, is high-strung and nervous, has suffered from "sick headaches" all her life.

Marital History—Single.

Habits—No alcohol, no tobacco ("They don't agree" with him). He gave up coffee and tea because of bad effect on heart.

Occupation—None recently, formerly clerical.

Past Health—Never robust, "has always taken good care" of himself. Tonsillectomy

* This is a review of the literature of internal medicine on the subject without reference to the psychiatric literature.

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was done in childhood because of frequent sore throats and "suspicion" of rheumatism. Appendix was removed at 18 for "chronic appendicitis". Weak stomach has persisted in spite of operation, and he has to be careful of what he eats. Kidney "damaged" by scarlet fever in early childhood. Frequent urinalyses have been negative, but patient complains of marked fluctuations in the volume and the color of the urine. He has always been nervous and easily fatigued. Hands and feet are sensitive to changes in temperature, and become white or blue when exposed to cold.

Present Illness—Was suspected of rheumatism and "weak heart" in childhood and palpitation has always been present during any exertion or excitement. He "was never allowed" to take part in competitive sports and has felt inferior physically to others of his own age. He "never got over" his attack of grippe three years ago, and since then has had gradually increasing pain in his heart, shortness of breath, dizziness, faintness and weakness. All his symptoms are made worse by exertion or nervous strain.

He has consulted several "specialists" but "has gotten no satisfaction". Opinions have ranged from valvular disease with myocarditis to nervous heart, and advice has varied between limited activity with digitalis every day, and "go home and forget about it". He thinks all the best doctors have found something wrong with his heart, the others have not understood his case.

The immediate reason for seeking further medical attention was a particularly severe and terrifying attack of palpitation, during which his heart beat furiously and irregularly. The pain was so agonizing that he could not catch his breath, and he thought he was going to die.

Physical Examination—A rather poorly developed young man who appears nervous and apprehensive. Facial expression shows exaggerated, but unsustained, responses to emotion. Transient vasomotor changes occur over face, neck and upper thorax where there is a blotchy, rather mottled appearance. He is unable to sit or lie quietly. Eyes, hands, feet and body are in constant jerky motion.

Thyroid gland—Palpable but not enlarged.

Thorax—long and thin, with good expansion. There is tenderness to firm pressure over precordium, maximal, near the left breast. This same area shows hyperaesthesia to gentle stroking. The border of the left pectoralis major muscle between the breast and the axilla is tender when squeezed firmly, but this finding is not present on the right side.

Heart—Apex impulse is visible, diffuse and forceful. A systolic thrill seems palpable over it. The heart is not definitely enlarged to percussion. The heart sounds are rapid and muscular, and their rhythm is not entirely regular. A blowing systolic murmur is audible over the whole precordial area, and the second sound in the pulmonic region is "impure".

The arterial blood pressure varies, initial readings of 150 systolic and 95 diastolic falling later to 130 and 80 respectively.

Extremities—Hands, cold and clammy, with nail bed definitely cyanotic. Excessive perspiration is visible in the axillae and on the feet. The tendon reflexes are overactive, but equal.

CLINICAL EVALUATION

In a situation such as this there are symptoms and signs suggestive of pulmonary tuberculosis, hyperthyroidism, rheumatic myocarditis, angina pectoris and hypertensive vascular disease. On the other hand the clinical picture could be regarded as an exaggeration of the usual cardiovascular disturbances seen during a convalescence from severe illness or during a "normal" response to severe physical or emotional strain. The differentiation is a difficult one, but there are some important aids in making an accurate clinical evaluation.

1) *Duration of Symptoms*. The history of symptoms developing in childhood and persisting from then on is characteristic of a majority of these patients (112). During the war consid-

erable emphasis was placed on the importance of this "constitutional type" (17, 51). At that time the cases which developed in men who had no pre-enlistment symptoms, were classified as "acquired" and their origin related to the severe physical and emotional strain of warfare (62, 97). The civilian counterpart of this second group is seen in those patients who date the onset of their symptoms to some specific trauma, either physical, infectious or psychic. (2, 53).

2) *Constant precordial pain:* The character of the pain complained of by these patients often serves to differentiate it from pain of organic disease. Frequently they deny that they are at any time free from precordial discomfort. There is always a soreness, or a dull ache, or some other sensation, most often centering in the region of the left breast. This basic pain may be accentuated at times into an agonizing state or a severe pressure, but, if it is accentuated, the stimulus for the change is more often emotion than exertion. The steady nature of the pain, its localization near the apex, and the lack of clear correlation with exercise, are important in clinical diagnosis. (6, 48).

3) *Complaint of giddiness, dizziness, faintness and exhaustion:* These are not common symptoms of organic heart disease unless there is some obvious physiological mechanism, such as paroxysmal arrhythmia or complete heart block, to explain them. These complaints are very prominent in the histories of the neurosis patients, and when accompanied by the symptom of constant precordial pain, are very strongly suggestive of the presence of a large emotional factor in the origin of the disturbance (129, 130).

4) *Frequent sighing:* In any type of neurosis the patient may give a history of frequent sighing. He usually attrib-

utes this to a feeling of dissatisfaction over the depth of inspiration, the sensation originating in the chest wall itself, which seems unable to expand normally (6). Since such a sighing tendency is not commonly present in patients with organic heart disease, a history of this sort is important in cardiovascular diagnosis (7, 136).

5) *Precordial and pectoral tenderness:* Hyperaesthesia, usually most marked along the left border of the sternum, is a frequent finding during acute episodes of coronary thrombosis. Its presence is usually transitory, lasting only a few days. In patients with cardiovascular neurosis examination of the precordium frequently reveals tenderness to gentle pressure (88). This is usually maximal near the apex of the heart. Not uncommonly there is also tenderness of the lateral border of the left pectoralis major muscle between the breast and the axilla. Hyperaesthesia may also be present to light touch over the precordium and in the left interscapular region (6). Physical findings of this sort suggest that the individual has a hypersensitive nervous system (66), unless there is concomitant evidence of an acute myocardial infarction.

6) *Disturbances of peripheral circulation:* The functional insufficiency of the heart damaged by organic disease must be severe before there is an easily visible effect on peripheral circulation. When cold, clammy skin, severe cyanosis of the nail beds, and excess perspiration appear as the result of myocardial failure, there are inevitably other signs pointing to the organic nature of the trouble. A large majority of patients with cardiovascular neurosis show obvious abnormalities of peripheral circulation (96, 108). Dermatographism is frequent (37), and Raynaud's-like syndromes are not uncommon (16). Ever since the earliest

clinical descriptions, excessive perspiration has been recognized as a characteristic feature (42).

7) *Instability of pulse rate and blood pressure*: Patients with cardiovascular neurosis almost invariably show abrupt fluctuations in pulse rate and blood pressure (29, 35). It is not uncommon for the pulse rate to change by 20 or 30 beats per minute under observation (62, 114), and the blood pressure may show comparable variations on successive readings (77). This degree of lability is not a characteristic of organic heart disease, except where auricular fibrillation is present, and is therefore an important aid in clinical analysis.

8) *Size of the heart by teleroentgenogram*: In spite of the fact that many patients with cardiovascular neurosis show a diffuse apex impulse and seem to have large hearts on physical examination, an X-ray usually shows the heart to be normal in size, or even rather smaller than the average (51, 89, 120). This absence of hypertrophy is a finding of extreme importance, especially in patients whose symptoms have been severe and of long duration.

9) *Electrocardiogram*: The full extent of the electrocardiographic abnormalities which may reasonably be attributed to functional disturbance is not definitely known. Certainly tachycardia, marked sinus arrhythmia and extrasystoles of various origins are seen in patients with neurosis. More important are the reported changes in PR interval, in duration of QRS complex, and in the form of the T waves (46, 56). Unless considered in the light of the whole clinical picture, such findings as these are apt to lead to an erroneous diagnosis of organic disease.

10) *Basal Metabolic Rate*: It is difficult to get a satisfactory estimation of oxygen consumption in neurotic patients because their exaggerated emo-

tional response to the minor annoyance of the test method prevents them from reaching truly basal relaxation. In spite of this, very few of these patients are reported to have a high metabolic rate (107). If at the first test a high rate is reported, this should be largely discounted. Reassurance and practice with the apparatus will usually result in a fall of the oxygen consumption to a normal level (63, 81, 109). Only diagnostic confusion will result if the patient is given iodine during the time these repeated tests are being done.

PERSONALITY OF THE PATIENT

In this group of patients, there is nothing of greater value in the clinical appraisal of the situation than an intelligent observation of the person who is sick. There are certain personality characteristics which are met with often enough to justify special emphasis on them. This does not mean that the detection of a personality defect in the individual relieves the doctor of the responsibility of a careful search for concomitant organic disease.

1) *Attitude toward treatment*: Most patients with organic heart disease, unless their symptoms are severe and disabling, have difficulty in adjusting themselves to extreme limitation of physical activity. The physician, to get adequate cooperation, must emphasize to them the need for rest. The patients with cardiac neurosis present a sharp contrast. As a group, they acquiesce instantly in a limitation placed on their exertion (75, 83). If told to rest they are apt to stay in bed for days or weeks. They frequently give a history of self-imposed rest cures, undertaken because they "thought it would be good for the heart."

2) *Preoccupation with visceral sensations*: In talking to patients with cardiovascular neurosis, the physician

may detect a degree of inattention on the part of the patient which seems incompatible with the obvious concern the patient shows about his condition. Scrutiny of this attitude of the patient results in the impression that he is so occupied with the registration and analysis of his own visceral sensations that there is not room in his mind for receiving and appreciating the external stimuli of the physician's words (84, 92). This concentration on internal afferent impulses seems to be a factor in the frequent complaint, made by the patient, that he has a poor memory, cannot concentrate, cannot think clearly (20).

3) *General lack of stamina*: Most patients with cardiovascular neurosis show an obvious lack of endurance, both nervous and physical. They seem unable to persist in any effort which is associated with even moderate distress. In one group of cases this lack of stamina dates back to childhood. They never learned to keep on when the going was hard (19). Quite a different picture is shown by the second group. These people have tried; in the past they have made honest, even excessive, efforts in their struggle with life. But for one reason or another they have become convinced that to contend is no longer worth while, that they cannot resist the overbearing unsympathetic forces of their environment. The history in the two groups is different, but their mental state is much the same. They are all certain that the present is bad, and that the future is to be even more dangerous and difficult.

SPECIAL STUDIES

The intelligent use of clinical observation and the routine laboratory procedures will often be sufficient to answer the problem presented by the patient. In some difficult situations more elabo-

rate methods of study are necessary.

1) *Respiratory patterns*: Sighing as a symptom of neurosis has been mentioned. Even when the patient gives no history of this sort, frequent sighs may be found in the tracing made for the routine basal metabolism determination (28). This may reasonably be considered objective evidence of unsatisfactory regulation of an automatic physiological mechanism. Perhaps to prove of even greater significance is a study of the general pattern of breathing, since it reflects chemical, autonomic and psychic factors in the individual patient. Previous investigations and some work in progress in this Clinic,¹ suggest that certain patterns of respiration may be correlated with the presence of abnormal autonomic and psychic influences on bodily function (93, 115, 125). It is safe to say that examination of the spirographic tracing, for its general pattern as well as for the presence of frequent sighs, may be of definite help in the study of the case.

2) *Adrenalin Test*: The subcutaneous injection of 0.5 cc of 1-1000 epinephrin solution has been used to determine the irritability of the cardiovascular system. When the test was first introduced, a "positive" reaction, consisting of a rise of 10 or more in pulse rate or systolic blood pressure, was considered pathognomonic of hyperthyroidism (54). It was soon shown, however, that many cases of cardiovascular neurosis responded more or less violently to this test dose (30, 50, 105, 106, 127, 131). This method has been discredited as a diagnostic aid (69), but it has some usefulness in the cases under discussion. A positive reaction reveals the presence of an abnor-

¹ This study is being aided by a grant from the John and Mary R. Markle Foundation to the Constitution Clinic of the Presbyterian Hospital.

² See footnote 1.

mally labile vasomotor apparatus, and, by its tendency to reproduce the symptoms of an attack, is quite impressive to the patient.

3) *Atropine Test*: The tachycardia observed in patients with cardiovascular neurosis suggests an overactivity of the sympathetic nervous system. Some question has been raised as to whether parasympathetic inhibition of the heart rate is deficient or is normal, but overwhelmed by the excessive accelerator stimuli. Atropine has been used to measure the amount of parasympathetic activity, the rise in pulse rate after large doses of the drug being a rough measure of the degree of inhibition present before the test. During the war, cases of "irritable heart" were found to react to atropine with a normal rise in pulse rate, the conclusion being made that vagus inhibition was not deficient (36, 124). More elaborate studies (43), and some investigations under way in this Clinic,² suggest that in these patients both sympathetic and parasympathetic overactivity is present. This contributes toward the analysis of the clinical picture, since many of the patients have gastrointestinal overactivity (95), a finding impossible to explain on a purely "sympathicotonic" basis.

4) *Hyperventilation Test*: Most of the dyspnoea of which the cardiovascular neurosis patients complain is not true air hunger, but literally a "shortness of breath," a feeling that deep breath cannot be achieved. The patient usually localizes this sensation in the chest wall itself, and describes a constant dissatisfaction similar to the transient annoyance which a normal person has after attempting a sigh but not quite attaining the complete expansion desired. The persistence of this somatic sensation is an adequate stimulus for repeated sighs. More important physiologically, it is also a stimulus for

hyperventilation since it persists quite without relation to the volume of air breathed. This mechanism, easily stimulated by emotion, may produce alkalosis quickly in a patient who has an unstable type of control over visceral behavior (80, 121). The use of voluntary hyperventilation as a test method is of value because it may demonstrate a hyperirritable autonomic nervous system, and reveal to the patient one factor in the production or perpetuation of his symptoms (68).

5) *Exercise Tests*: Measurements of the response to various types of exertion have been used to assist in the diagnosis of cardiovascular neurosis (65, 76, 87, 99). They serve to point out a physiological abnormality in the patient as compared to the normal person, but aside from this their usefulness is limited. Such tests do not help in the differentiation between circulatory disturbances of organic heart disease and those of neurosis. In the neurotic patient, the response is no more dependent on the amount of exertion than it is on the emotional reaction he has, the fear he has that the test will injure seriously his already weakened heart (79).

6) *Infusion Test*: Intravenous injection of 1,500 cc of normal saline solution in 30 minutes, produces no significant change in venous pressure or vital capacity in a person with a normal cardiovascular apparatus (26, 113). A normal response to an infusion test may be valuable evidence in a patient with cardiac symptoms but no objective evidence of organic disease. However, in a case with no other signs of heart damage, an abnormal reaction to infusion must be interpreted with caution, since some patients with clear-cut cardiovascular neurosis show significant changes in venous pressure and vital capacity under the conditions of the test. This is probably best explained as

evidence of faulty regulation of cardiovascular function and inability to adjust the capacity of the vascular bed to the rapid increase in blood volume, rather than as a sign of myocardial insufficiency. The view that the changes are peripheral in origin is given strong support if the velocity of blood flow is measured at the height of the venous pressure rise and found to be normal.

7) *Anoxemia Test*: This technique, which involves an apparatus for changing the oxygen content of the inspired air without the patient's knowledge, has proven useful in determining the origin of cardiac pain. Many patients with "angina of effort" get pain after breathing gas mixtures containing 12 per cent oxygen, but are comfortable when recumbent and breathing air or pure oxygen (72, 73). In the neurosis patients there is apt to be no correlation between the severity of their pain and the oxygen content of the air they breathe.

8) *Apnoea Time*: A simple test, but one of considerable interest, is a measure of the time during which the patient will hold his breath. Such a maneuver stimulates definitely uncomfortable visceral sensations, and these increase in severity as the duration of the experiment increases. Patients with cardiovascular neurosis may reveal their lack of stamina and their intolerance of physical discomfort by their response. In one series of cases, individual controls held their breath from 35 to 45 seconds, while the patients averaged only 10.9 seconds (45).

INTERPRETATION OF THE SYNDROME

It is not possible to give a satisfactory explanation of the mechanism by which the disturbances seen in patients with cardiovascular neurosis are produced. Many theories of etiology propounded in the past have been shown

to be unsound, or to apply to a selected group of cases (139). Pressure from clothing (86), prolonged physical strain (58, 70, 128), infections of various sorts (8, 24, 42), overactivity of the thyroid gland (1, 10, 18, 123), hyperirritability of the autonomic nervous system (9, 40, 52, 85, 140), decrease in the buffer salts of the blood (74), overindulgence in tobacco (5, 102), hereditary taints (60, 82, 98), unfavorable environmental influences in childhood (17, 64, 67), and psychic instability (17, 40, 94), have all been suggested as basic causes of the syndrome. As usual when opinions vary widely there is probably at least a fragment of truth in each point of view expressed. In other words, every part of the organism and the whole of the individual's experience (118) contribute something toward the development of the complete clinical picture (3). Analysis of the relative contribution of any one factor must be inaccurate until there is a scientific method for studying personality as a whole and for analyzing the meaning and mechanics of human behavior (21).

Within the zone of automatic visceral function in any human being, exaggerated motor responses, from whatever source derived, provide by their effect on secretion, muscle tone and muscular contraction, the stimuli for abnormal afferent impulses. There is, therefore, inherent in every individual, a mechanism for the perpetuation of abnormal function once the disturbance has been initiated (13).

Abnormal physiological processes may be started by a constitutional defect, a disease, a strenuous physical effort or a difficult emotional experience. Adaptability of the average human organism is such that satisfactory functional equilibrium is obtained. However, if the factors initiating a functional disturbance persist, their ex-

pression in abnormal visceral behavior may continue in spite of the best physiological adjustments of which the body is capable.

In any individual, the pattern of abnormal reaction through which he manifests disturbed visceral behavior depends on the type of handicap inherent in his equipment (49), and on the specific character of the stresses to which his organism must adjust itself. When, in him, any particular pattern has been blocked out, it tends to perpetuate itself by reason of the intensity of the afferent impulses stimulated by the unusual motor activity *per se*, and because of the increasing ease with which the reflex pathways involved respond to stimulation (22, 23, 46, 90 132).

The general interpretation of neurosis may be based on physiological considerations such as these, but establishment of a neurosis in an individual must depend on purely psychological factors (138). Abnormal visceral sensations occur in every person under a variety of circumstances (15), but are "forgotten". Such sensations lead to neurosis only when they are misinterpreted (117). Faulty evaluation of the sensations is favored when they are persistent, when the analysis of them is conditioned by some instinctive anxiety, or when in the individual there is some psychological necessity for using the symptoms as a protection against the pressure of environmental forces (32, 142). If such a concept of neurosis is accepted, the frequency of the cardiovascular type may be explained (61, 135). Whenever the organism is subjected to infectious, physical or psychic trauma, the heart is apt to be the source of rather uncomfortable sensations. Common usage has served to focus in the heart the instinctive anxieties arising from the individual's effort at self-preservation.

MANAGEMENT OF THE INDIVIDUAL CASE

The clinical problem presented by the patient with cardiovascular neurosis is a difficult one. At the start the doctor must convince himself of the accuracy of his diagnosis so that his therapeutic efforts will not be hampered by a lingering uncertainty about the presence of undiscovered organic disease. The patient must be sure that the disabling nature of his symptoms is fully understood (101, 133), and that the physician is using all available diagnostic methods in an effort to determine the origin of his trouble. The clinical and laboratory investigation must be thorough, the exact nature of the tests used being adapted to the requirements of the individual case.

After a diagnosis has been reached the patient must be led to understand the mechanism by which symptoms may be produced (31, 38). In most cases this is not accomplished simply by careful study, a diagnosis of "nervous heart", and advice to "go home and forget it". The patient has more often than not had experience with the use of the word nervous as a synonym of imaginary, and, unless this association is broken down by careful explanation, there is an important obstacle to his acceptance of the functional origin of his symptoms.

No satisfactory results can be obtained if the patient is led to believe that he can cure himself by accepting a rational explanation of the processes involved, and by controlling himself through an effort of will. The patient must understand that the physiological mechanisms involved are independent (41), that they are reflex responses of a normal type exaggerated by special factors in his particular case. He must expect to have symptoms whenever stimuli of sufficient intensity develop

either from his environment or from within his own nervous system. His nervous energy is wasted if used in attempts to control these reflexes, but may be productively used in efforts to understand their origin and interpret them reasonably. In this way the patient may recondition his apparatus but not eliminate tachycardia as a normal response to exertion and emotion.

Before instituting any specific therapeutic measure, the physician must consider not only the possible physiological benefits, but also the full implications of the treatment in the patient's mind. Most people know that bed rest and digitalis are prescribed for patients with serious heart disease. A cardiovascular neurotic, given this kind of treatment, is apt to be more convinced than ever that he has organic cardiac damage (34). Moreover there is no evidence that either rest or digitalis is beneficial in this disorder (75, 87, 100). Exercise to improve muscular strength is indicated in all cases (119, 122), but if it is begun too energetically the patient has his symptoms accentuated and finds difficulty in believing that he is on the road to recovery. Mild sedation with phenobarbital, chloral hydrate, or bromides, explained to the patient as a method of diminishing the irritability of the nervous system, but with no direct effect on the heart, is a generally valuable measure. Benzadrine sulfate in small amounts may be useful as a temporary aid in treating the more depressed and exhausted patients (141).

Resort to the formal methods of psychotherapy must be considered in every case, but only after a most careful physiological analysis of the situation has been completed. The psychiatrist is not given a good opportunity to be effective if the patient feels the medical aspects of his illness have been

neglected. Many of the cardiovascular neurosis patients, treated without formal psychotherapy, can reach a satisfactory compromise under which a persisting constitutional or psychological problem does not interfere seriously with autonomic regulation of physiological activities (34, 68).

Surgical denervation of the adrenal glands has been reported to give favorable results in the treatment of neurocirculatory asthenia (4, 39). The evidence as presented in the literature is not adequate to prove any specific connection between the operation and the fundamental problems of cardiovascular neurosis. The procedure does seem to offer a rather limited approach to the total personality of the individual (111).

THE GENERAL PROBLEM

It is probable that the neuroses in general, and cardiovascular neuroses in particular, are to become an increasingly large part of medical practice (27, 59, 137). This trend may be related to such factors as the tension of modern living, the severity of economic competition, and the growing importance and diversity of disability benefits (44, 103). Certain problems of great social significance are presented to the physician.

Lay education in medical matters is becoming more extensive every day through health campaigns, the columns of the daily papers, and the popular works of numerous medically trained authors. The amount of real knowledge imparted to any individual in the curious and uncritical audience is very small; but it is a sensitizing dose, sufficient to make him react allergically if there is instilled into him any doubt about the integrity of his own vital processes.

Into this situation, like a spark into

a box of tinder, comes the physician who is unable or unwilling to consider his patient as something more than an isolated mechanical unit. An individual who has noticed some cardiac symptoms during a time of physical or mental strain, and has become anxious about his condition, may have his fears accentuated by an excessively careful physical examination of the heart or by the expression on a doctor's face as he measures blood pressure, unless his questions be answered by reasonable discussion of the problem (12, 91, 104, 110).

No less dangerous are physicians who for one reason or another have never accepted the idea that important, sustained and disabling physiological abnormalities may occur in the absence of any organic disease (138). To such men the prolonged symptoms and definite physical signs of the cardiovascular neurosis patient are clear-cut evidence of structural damage (11). Even if careful study fails to reveal rheumatic activity (78), tuberculosis (71), thyrotoxicosis or significant focal infection, they continue to interpret the picture as one of undiagnosed disease, supporting their opinion by minor physical signs in the heart (33), or minimal form changes in the electrocardiogram. This point of view is readily transmitted to the patient, and once implanted can be uprooted only with greatest difficulty (116).

Probably the most frequent source of cardiovascular symptoms focussing the attention of the individual on his heart, and leading to neurosis if the total personality situation is ready, is the normal disturbance in function during or following an acute infectious disease (126). Even a mild cold may be sufficient to disturb the temperature regulating mechanism enough to make the patient feel sensitive to a draft of air and jump to the conclusion that his

circulation is not good. Here the doctor may contribute to a later cardiovascular neurosis, by failure to limit the patient's physical activities during the convalescent period of vasomotor instability (14, 25), or by failing to convince the patient that the symptoms are a normal, but temporary, manifestation.

RELATION OF CARDIAC NEUROSIS TO ORGANIC HEART DISEASE

There is no clinical evidence available that the circulatory disturbances of cardiovascular neurosis make the individual susceptible to organic heart disease. The after-health of cases diagnosed during the war and followed for five years was comparable to that of other population groups (55).

On the other hand, organic heart disease is a potent factor in the etiology of cardiovascular neurosis (134). Anxiety arising from the knowledge that the heart is not normal may initiate a train of physiological disturbances more disabling than the underlying disease itself (47). Such a complication is facilitated by an over-solicitous attitude of the patient's family toward minor symptoms, or by the physician who treats heart disease as a purely mechanical problem and fails to help the patient make his psychological adjustment to the presence of damage in a vital organ (57).

Evaluation of the part neurosis plays in the symptoms of a patient with recognized structural disease of the heart, is one of the most difficult problems in cardiovascular diagnosis and is beyond the scope of this review. All the skill of an experienced and well-equipped clinician may be insufficient to gauge with accuracy the relative importance of the two factors, or to get any symptomatic improvement

with the kind of reassurance he is justified in giving to the patient.

SUMMARY

Cardiovascular neurosis is a clinical syndrome arising from complicated alterations in the total personality of the patient. Its physiological manifestations can be separated from those of organic disease only by careful clinical and laboratory study. Treatment of the condition, if it is to be successful, must involve a reconditioning of the individual's interpretation of, and response to, afferent visceral impulses. In many patients the symptoms have been precipitated or perpetuated by faulty medical supervision of the difficult problems involved.

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SURGICAL ADDICTION—A CASE ILLUSTRATION

PHYLLIS GREENACRE*

THE PATIENT WAS SEEN in the Psychiatric Out-Patient Department over an 18-month period. She is representative of a group of cases with which we, in a psychiatric clinic of a general hospital, become quite familiar, and I am quite sure it is a group which the medical or surgical physicians also encounter, for patients of this general type usually come to them first. In the private office of the psychiatrist this sort of patient is less frequent for she is commonly psychiatry-shy and may avoid or resist, rather than seek psychiatric help. The only and best excuse for reporting this or similar cases is the possibility that the mutual consideration of the patient's situation and life history by psychiatrists and general physicians may give us some leads for the future.

The patient, a woman of 54, came to us in 1937 with a complaint of pain in the ethmoid region for 3 years; stomach trouble for 10 years; pain across the lower abdomen for 2 years; and transient sensations of a dead feeling over the back of the head and chest following periods of emotional upset for 2 years. I am quoting from the patient's own statement of her difficulty and it is to be noted that her symptoms are all in somatic terms and betray some degree of medical sophistication. She

had, in fact, been referred from the Medical Clinic where she had been considered as predominantly a case of hypochondriasis, and this diagnosis seemed borne out by her examination in 7 other clinics as well. The number of examinations, necessary to arrive at this diagnosis, is really impressive.

This was not the first period of examinations with which this patient was acquainted. Her hospital experience began 32 years ago, when at the age of 22, she first had a dilatation and curettage; this was followed at 24 by a uterine suspension; at 30 there was a right kidney suspension and an appendectomy and later in the same year an ovariectomy, hemorrhoidectomy and another dilatation and curettage. At 39, there was a new operative bout, with another suspension of the right kidney and in the same year an operation on the nasal septum. At 40, a complete hysterectomy was followed by peritonitis. At 41-42, a tonsillectomy was done, and next a bilateral antrotomy—which had to be repeated on the right side. At 49, the right kidney was removed and at 52, finally an ethmoidectomy was accomplished. When one looks over this table of operations, it is apparent that they have occurred in general at four periods in the patient's life: the first at 22-24; the second at 30-31; the third at 39-40; and the fourth at 49-52. Thus curiously enough, we note that roughly the patient enters each decade of her

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life with a surgical initiation; and that the operative work has, as it were, extended itself from below upward, beginning with the genito-urinary system, making a detour into the gastrointestinal system, and finally coming to rest in the naso-pharynx.

In the psychiatric clinic we became inquisitive about what sort of person this was who had subjected herself to so much cutting and so we asked the patient simply to tell us about herself and in a series of interviews she did so. She started at once with her childhood and stated that she had been nervous ever since her earliest years, when she had suffered first from fear of the dark and sleepwalking, and later fainting spells. She had grown up in army camps in the West where her father, an army officer, was engaged in skirmishes with the Indians. We could not reconstruct much of this early period from the scant memories of the patient but in general it was a period of exposure to fighting, moving about, and insecurity, and certainly these first early symptoms were outcroppings of childish anxiety and fright. She was an only child except for a half brother 11 years older, who died when she was 7. Following this her mother had become increasingly alcoholic, subject to outbursts of angry, disturbed and even violent behavior, and went through some sort of psychosis which lasted for approximately three years. After this, although improved, she continued to be nervous and the little girl was somewhat afraid of her.

The child was sternly brought up by her father, who guarded very zealously any contact she had with boys—called himself for her at any time that she went out to parties with boys—and surrounded her with a strict protectiveness that seemed to imply great danger. According to her best recollection, she had no sexual knowledge whatsoever

when she was surprised by her menses at 14. I am inclined to doubt whether this could have been strictly true in the rough and tumble life of western army camps and so disturbed a family situation as the child was subjected to. While this can now certainly be only a matter of conjecture, it seems more probable that what the child learned was from unofficial sources, and that her ideas of sex were colored by hints that it was fraught with peril and possible injury for a girl—whose chief defence lay in being a lady—and that this early unofficial learning has been hidden or forgotten. At any rate, she interpreted the menses when they occurred as evidence of injury and thought she had hurt herself in falling from a tree. She then began to have fainting spells and was diagnosed as having a floating right kidney, and became increasingly delicate, fearful and body conscious.

She became engaged at 17 and the four years' engagement period which followed was a model of prim decorum. With the marriage at 21 and almost immediate pregnancy, there was a new exacerbation of distress. She felt that she suffered extreme injury and hemorrhage on her marriage and that the pregnancy and labor were too difficult ever to be repeated. It was in this setting of renewed anxiety that the surgical intervention began. I shall not attempt to reconstruct the patient's life story in detail from the somewhat sketchy data we have. The patient never attained any normal sexual response—was frigid throughout her life, had no further pregnancies after the first one, showed a highly ambivalent attitude toward her only child and progressively built her life story around her medical and surgical treatment. I am chiefly concerned in this patient with the effect of treatment for it is this which is now most apparent, while the original primary neurosis shows through only

unclearly from behind the secondary neurotic attitudes which are in the foreground. Neither can we now, from behind the screen of these 16 or 17 operations and the lapse of so many years, say much as to the positive indications for the various procedures undertaken. The patient now makes the impression of a morbid willingness to submit to any operative procedure, in the hope of a miraculous relief—which is contrary certainly to all the experience which she has gathered in the past 30–35 years. In other words she now shows an attitude of addiction to surgery, somewhat similar to other forms of addiction.

That the patient was afraid of life and especially her rôle as a woman and that this fear was not a clear, rational and definitely apprehended one seems apparent. She effectively negated her life by a flight into illness, which has, however, been so painful in itself and so destructive in its sequelae that it seems utterly paradoxical as a retreat.

DISCUSSION

What is the effect of operation on such a patient? Whether the first operative measure is undertaken on imperative physical indications or largely on the patient's invitation, the operation itself is likely to leave a considerable stamp of its own. It temporarily displaces the underlying anxiety, legitimizes and focuses the distress in which the attention and interest is now invested. To an extent it replaces the old vague danger felt as anxiety with a definitely known one which is the center of active concern. And since there is relief in definite action as in contrast to apprehension, apparent improvement may immediately occur. In homely terms, it gives the patient something to worry about. A severe physical illness or injury of any sort may act in a similar way. At the same

time, such illness in itself reduces the position of the patient to one of helplessness, dependence and need for special protection in the way of nursing and medical care—to a position comparable only to the infantile dependence of the earlier life. That patients react to this with an emotional attachment to those around them at the time of the suffering is general experience. In the anxious or neurotic patient with a specially strong need for security this interlude of accepted dependence is especially valued and coveted. And, since pleasure and pain are somewhat relative and each is increased by contrast with its opposite, in an operation with its initial sharp suffering followed quickly by a longer period of convalescent care, the illusion of positive gain may be increased, and the operation becomes not only the substitute for the underlying anxiety, but the price of purchase enhancing the illusory value of the whole experience. An operation is more likely to be a distorting influence than other types of somatic therapy, not only because of the sharp contrast accentuation of the pain and relief, and the degree of inevitably helpless dependence, but further because it succeeds more than any other procedure in presenting a dramatic crisis, to which both the patient and the family rise acutely; and invests the whole situation with an heroic excitement. But since naturally the whole experience has not generally touched the source or well spring of the old anxiety, the patient's improvement is frequently only temporary. The degree of sustained improvement depends naturally in some measure on the amount of somatic pathology which has been corrected by the treatment given; where this is slight, or practically negligible, so that the actual physical efficiency of the patient is not increased by the treatment, the pa-

tient's improvement sometimes collapses immediately if he must return at once to the old situation which has been pressing upon him. Sometimes he gains a kind of exemption from life through being a semi-invalid and can then ask for, or earn without asking, sympathy, tolerance and special privileges from those around him, and be able to carry on by this means—actually reshaping his environment to meet his own unique needs. In this way his convalescence may in a sense be prolonged indefinitely and the original anxiety producing disturbance silenced at the expense of a crippled life—*i.e.*, a satisfying neurotic symptomatology established.

From a review of a group of these cases seen in our clinic, I am inclined to think, however, that the frequent, almost cyclic, repetition of the operative procedure is relatively common. When the original neurosis is never dealt with, the secondary effects of operative procedure which in the relatively non-neurotic patient are absorbed again in the healthy activities of everyday life and interests, form the nucleus of this secondary neurosis consisting of a genuine addiction to surgical interference. Sometimes this is very striking in the behavior of the patient who haunts one doctor after another, feeling essentially a rebuff from and even a persecution by the doctor who refuses active treatment.

What can be done about such patients? After the situation has developed fully, they constitute one of the most severe problems of reconstructive therapy. In a city like New York they turn from doctor to doctor and from clinic to clinic, playing one medical opinion against another to no one's benefit and their own slow self-destruction. In a metropolis, we are not in as

favorable a position for knowing and dealing intelligently with the total personality aspects of our patient's needs as is the general practitioner who, just by virtue of his life among them, knows something of the personal situation of his patients.

Obviously the ideal answer would be to have such patients treated psychiatrically at the outset of the illness; perhaps this goal may be attainable at some time in the future when mental medicine has developed and been assimilated beyond its present status. But, with the insufficient number of trained psychiatrists today, not to mention the paucity of the non-institutional psychiatrists 30 years ago, this was probably not even remotely feasible for this patient. Such conclusions as we can draw from her case have to be in the nature of examining the barn door after the loss of the horse. It would seem, however, that where there is anxiety—expressed either directly in terms of feelings of anxiousness or in the classical forms of palpitation, shaking, breathlessness and choking—together with physical distress but with negative or very slight physical findings, the utilization of drastic painful methods of treatment, especially surgical, means the possibility of gain through the positive suggestion of the treatment (which is often hoped for) is more than counterbalanced by the danger of the establishment of a definite appetite for the pleasure-pain experience and this is increased with each repetition until a definite habituation may result.

If it is not possible to get direct psychotherapeutic help in such instances, at least conservative supportive treatment is more favorable in the long run and tends less to reinforce the neurosis.

REVIEWS, ABSTRACTS AND CORRESPONDENCE

RECENT DEVELOPMENTS IN THE FIELD
OF MEDICAL SOCIAL WORK

HARRIETT M. BARTLETT*

THE AMERICAN ASSOCIATION of Medical Social Workers is working on two projects which have to do with the integration of medical and psycho-social factors in the care of the patient and seem likely to provide data relevant to psychosomatic problems in medicine.

The first of these is a study of some common difficulties which illness and medical care present to clinic and hospital patients, as observed in medical social practice. For this purpose case narratives, specially prepared to bring out the material needed, have been obtained from medical social workers in various parts of the country. Some of the points stressed have been as follows: What kind of a person is this patient? What was the particular meaning of the medical situation to him? In what manner was the first contact made with him by the medical social worker and what was the detailed course of the subsequent interviews? What were the attitudes and goals of the various persons in the situation (relatives, hospital personnel, social workers in community social agencies, and the medical social worker herself) and how did these help or hinder the patient in meeting his problem?

The case material which has been obtained relates to steps in medical care which patients frequently find it difficult to take, such as facing a diag-

nosis like syphilis with implied moral stigma, or deciding to enter the hospital for surgical operation. The fears which many patients feel regarding helplessness during acute illness, mutilation of the body, loss of consciousness when taking an anaesthetic, separation from their families, responsibility for exposing another person to communicable disease, and similar experiences common in illness, are repeatedly revealed. The aim of the study is to clarify the rôle of the medical social worker in helping such persons to surmount the obstacles which environmental difficulties or their own conscious feelings may present, so that they may be able to move forward through the necessary steps in medical care on their own initiative. The effort has been to restrict the study to relatively uncomplicated problems, of a sort appropriately dealt with by the methods of social case work. The manner in which factors related to both personality and environment interact to produce blocking is being interestingly revealed in the material which has been collected.

The second subject of investigation concerns certain experiments in teaching medical students the approach to the patient as a whole and the social aspects of the medical care, which are being tried in various parts of the country. In about a dozen medical schools instructors in clinical medicine

* Cambridge, Mass.

and public health have invited medical social workers to take part in their courses for third-year and fourth-year students. This represents an opportunity for the social worker to contribute from the experience of medical social work both a point of view and specific data which are relevant to the new and broader concept of adequate medical care. The teaching method most frequently employed is the pres-

entation and discussion of case reports, which have been fully worked up by individual students to bring out the psycho-social aspects and which are used in class as a basis for demonstrating important concepts regarding the patient as a person and the social elements in a well rounded medical plan.

Reports on both of the above studies are in process of preparation and will be published in the near future.

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REVIEWS, ABSTRACTS AND CORRESPONDENCE

A REVIEW OF "THE EMOTIONAL FACTOR
IN VISCERAL DISEASE"*

THIS BOOK is a gift to the medical profession by an Oslerian physician who has gained a psychobiological orientation. More as a summing up of individual experience than as a critical or exhaustive review, Dr. McGregor describes simply and lucidly, for the medical practitioner, the elementary and fundamental facts of psychosomatic unity. With thoughtful conservatism he leads the reader back to the doctrine of organismal monism by way of physiology and the autonomic nervous system, and thus, briefly and engagingly helps define the liaison between organic and psychic mechanisms. Dr. McGregor does not concern himself in this book with recondite psychoanalytic concepts, nor does he engender opposition in the general reader by the use of unusual terminology. To the physician experienced in psychosomatic research the ideological background of this book will seem somewhat superficial and a rehash of what is generally known. Treating emotional states defined on a conscious or pre-conscious level, though with an occasional dynamic rabbit up his sleeve, the author relegates consideration of the conversion neuroses and of such concepts as that of organ cathexis—perhaps rather unnecessarily—to the field of psycho-analysis.

In four parts and nine chapters the

author discusses some aspects of the physiology and pathology of the gastrointestinal, the respiratory and the cardiovascular systems and reviews the functions of the endocrines and the vegetative nervous system, in relation to emotional states. He briefly describes some important and classical experimental research. An abbreviated chapter each is devoted to the subjects of clinical asthma, colitis, heart disease and peptic ulcer, and several to preliminary discussions of organ system physiology. Occasional interesting case histories are cited. The concluding division is a simple but significant discourse on diagnosis and treatment of disease under the telescopic lense of the new psycho-somatic orientation. There is a bibliography of four pages which is illustrative but far from complete.

Although McGregor shows a better grasp of the medical implications of psycho-somatic integration than does the author of the preface, whose philosophy seems still dichotomous, one feels here and there evidence of temporary regression to dualistic medical morality. The remark that infection still is probably the most frequent cause of recurrent peptic ulcer, the failure to differentiate fright from anxiety, the inadequate treatment of conflict, and some uncertainties of terminology, for example, are not altogether consistent with his usual clarity. He speaks, at the risk of considerable oversimplification, of such emotions as joy, sorrow, rage and maternal love in

* *The Emotional Factor in Visceral Disease*, by H. G. McGregor. London and New York: Oxford Medical Publications, Oxford University Press, 1938, 210 pp.

connection with somatic changes and refers to habit reactions, psycho-morphological correlations and heredity with more confidence than do some authorities. But this book, nevertheless, provides an introductory primer for Dunbar's *Emotions and Bodily Changes*, and contributes a first step for the emancipation of the medical profession from one of its turbid traditional ideologies—strict Virchow pa-

thology. Some concluding comments on the rapprochement between cultural resultants and individual emotional states might justifiably have followed. Essentially physiological in scope, this succinct and stimulating little book could perhaps have been more aptly titled *Physiology of Emotional Reactions*.

S.P.H.

A REVIEW OF "MEDICAL INFORMATION FOR SOCIAL WORKERS"*

PRESENTING MEDICAL INFORMATION to social workers is admittedly a difficult job and a new book in this field has long been necessary. As an orthodox presentation of medical facts this book, edited by W. M. Champion, is well done but the question arises whether more than that is not necessary in the instruction of social workers. In other words, it seems to the reviewer that the book is not written from a large point of view. It consists only of a series of rather common-place articles presenting facts about medical conditions. Even these are rather badly balanced as is bound to happen when a number of contributors are involved.

The social psychiatric point of view is not in much evidence and that is the great defect of the book. Some day a book for social workers will be written from such a point of view and will represent a distinct contribution to the

reciprocal educational efforts that are just beginning in this field. This refers to the very recent developments in medical education instituted in some 13 medical schools throughout the United States in which an effort is being made to instruct medical students in the social background of illness through cooperation between the medical department and the social service department. Furthermore, it is now required that schools of social work present a course in medical information for social workers and thus information concerning social factors in illness for physicians and medical information for social workers may do something to break down the false alignment that exists between these two groups. Had such efforts been made long ago instead of only recently perhaps we could have been spared some of the difficulties of the present day medical-social conflict.

Although this book is lacking in the respect noted, it nevertheless presents its medical facts well and will serve a useful purpose. It is a good beginning and can be safely recommended.

E. W.

* *Medical Information for Social Workers*, edited by W. M. Champion, with the assistance of contributors from the faculty of Western Reserve University School of Medicine, Cleveland, Ohio. Baltimore: William Wood Co., 1938, 529 pp.

BOOKS RECEIVED FOR REVIEW

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